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FORM OF ENTRY

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Entry No. in PA ↓ **Title of paper** ↓

87093 PAC study of molecular rotational motions in dilute solutions.
Authors → A.Baudry, P.Boyer, J.D.Fabris, P.Vulliet (Lab. d'Interactions Hyperfines, CENG, Grenoble, France). ← **Author's affiliation**
Source of paper → *Hyperfine Interactions (Netherlands)*, vol.10, no.1-4, p.1057-62 (June 1981). (Proceedings of the Fifth International Conference on Hyperfine Interactions, Berlin, Germany, 21-25 July 1980).
The rotational tumbling of neutral chelates of hafnium dissolved in several organic solvents was studied via ^{181}Ta DPAC experiments. The results are compared with the predictions of a hydrodynamic model with partial slip boundary conditions. The influence of solute-solvent interactions and/or associations on the quadrupole relaxation is discussed. (16 refs.) } **Abstract**

Entries for other types of material differ mainly in the reference to the source, e.g., a report will refer to the report series and the number of the individual report. A conference paper on the other hand will normally refer to the title, place and date of the conference at which the paper was given.

SUBJECT ARRANGEMENT & SUBJECT GUIDE

The abstracts are arranged by subject in accordance with the scheme in the CLASSIFICATION and CONTENTS which appears opposite. The page number for the start of each subject section is given. An alphabetical index to the scheme—the SUBJECT GUIDE—follows the CLASSIFICATION and CONTENTS.

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Where appropriate, the following subsidiary indexes are included for the convenience of users:

Bibliography index of articles where a significant list of references or bibliography is contained.

Book index of books received and abstracted.

Corporate Author index where a corporate organisation rather than an individual is responsible for publication. This index includes all reports.

Conference index with reference to individual papers.

Subscription prices and ordering procedure are shown on the inside back cover.

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CLASSIFICATION AND CONTENTS

The abstracts are arranged by subject in accordance with the following scheme. The page number for each section is given. The CLASSIFICATION AND CONTENTS is followed by an alphabetical guide to the scheme, the SUBJECT GUIDE.

The classification scheme is the result of cooperation between INSPEC, the American Institute of Physics, the European Physical Society and the Physics Working Group of the ICSU-AB.

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00.00 GENERAL

01.00 COMMUNICATION, EDUCATION, HISTORY, AND PHILOSOPHY

01.30 PHYSICS LITERATURE AND PUBLICATIONS

01.30C Conference proceedings

64572 5th High Energy Spin Symposium.
AIP Conf. Proc. (USA), no.95 (1982). [received: April 1983]
Conference held at: Westhampton Beach, NY, USA. Date Sept. 1982. The following topics were dealt with: spin; Thomas precessional frequency; particle magnetic moments; inclusive polarisation; exclusive polarisation; parity violation; T violation; resonances; dibaryons; phase shifts; deep inelastic scattering; quark models; QCD; polarised beams; polarised proton acceleration; polarised targets; polarised particle sources; polarimeters. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64573 XIII Congress of Theoretical Chemists of Latin Expression.
THEOCHEM (Netherlands), vol.10 (May 1983).
Conference held at: Alghero, Sardinia. Date 5-8 Oct. 1982. The following topics were dealt with: Time dependent Hartree Fock theory; local defects in crystals; atomic collisions; molecular electrostatic potential; chemical bonding; chemical reactivity; conformational analysis; nuclear electric shielding, coupled oscillators; dissociation reactions; molecular properties in liquid phase; quantum state to state reactive probabilities; circular dichroism; CNDO/S calculations of resonance Raman spectra; photodissociation and predissociation in strong electromagnetic field.

64574 Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys.
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.4 (1982). [received: May 1983]
Conference held at: Asha, USSR. Date 15-17 Sept. 1981. The following topics were dealt with: electrical engineering steels; electromagnetic losses; magnetic properties; recrystallisation texture; domain structure; Fe-Si alloys. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64575 Second International Symposium on Integrated Global Monitoring of Environmental Pollution.
Environ. Monit. & Assess. (Netherlands), vol.2, no.4 (1982).
Conference held at: Tbilisi, USSR. Date Oct. 1981. The following topics were dealt with: biosphere state forecasting and global state monitoring, environmental pollution of Europe and Asia (Eurasian continent), eutrophication by microbial uptake kinetics of dissolved organic matter, Lake Baikal, biological indicators and dispersion models in air pollution monitoring, pollutant transport, world ocean monitoring ecological principles and SO_2 detection using scotch needles.

64576 Meeting on Electrochemical Techniques in Corrosion Testing and Research.
Corros. Sci. (GB), vol.23, no.4 (1983).
Conference held at: Manchester, England. Date 4-6 Jan. 1982. The following topics were dealt with: impedance measurements; coated steel corrosion; stress corrosion cracking of stainless steels; intergranular corrosion susceptibility; depassivation of iron. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64577 105th Meeting of the Acoustical Society of America (papers in summary form only received).
J. Acoust. Soc. Am. (USA), vol.73, suppl.1 (Spring 1983).
Conference held at: Cincinnati, OH, USA. Date 9-13 May 1983. The following topics were dealt with: architectural acoustics; physiological acoustics; psychological acoustics; directional hearing; speech communication; noise; shock and vibration; physical acoustics; underwater acoustics; engineering acoustics; education in acoustics; and musical acoustics.

64578 Sixth Annual Conference of the American Society of Biomechanics (papers in summmary form only received).
J. Biomech. (GB), vol.16, no.4 (1983).
Conference held at: Seattle, WA, USA. Date 13-15 Oct. 1982. The topics dealt with included: motor performance and jet propulsion in Nautilus pompilius; the pressure and flow patterns inside an aortic bifurcation; the effects of smooth muscle activity on the mechanical and hydraulic properties of the dog aorta; evaluation of trunk deformity using light profiles; CT obtained bone geometry and density measurements using 2nd order correction; biomechanics of the knee extension exercise; torsion in ostrich knees; true stress and strain in mammalian skeletal muscle, comparative mechanics of mammalian spines; elastic energy storage and power output in squid mantle muscle; mechanics of orientation in sea pens; mechanical properties of cephalopod arteries. 65 papers were presented.

64579 Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3 (March 1983).
Conference held at: Yokohama, Japan. Date 13-16 Sept. 1982. The following topics were dealt with: electronic states; surface properties; transport phenomena; magnetism of thin films with artificial super structures; fine particles; Mossbauer spectroscopy; magnetoacoustic and elastic properties; magneto-optics; amorphous films; domains; structure and anisotropy; ion implanted films; experimental techniques. 102 papers are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64580 Physics of Non Crystalline Solids. Proceedings of the 5th International Conference.
J. Phys. Colloq. (France), vol.43, no.C-9 (Dec. 1982). [received: April 1983]
Conference held at: Montpellier, France. Date 5-9 July 1982. Sponsors: Int. Comm. Glass; Societe Francaise de Physique. The following topics were dealt with: structure; glass formation and devitrification; optical properties; transport properties; phonons and thermal properties; mechanical properties and surfaces; magnetic properties. 138 papers were presented, of which 136 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64581 45th Annual Meeting of the Meteoritical Society (papers in summary form only received).
Meteoritics (USA), vol.17, no.4 (1982).
Conference held at: St. Louis, MO, USA. Date 13-16 Sept. 1982. The following topics were dealt with: fluid inclusions, Fe meteorites, Solar System abundances, nuclear tracks, noble gases, breccias, Antarctic meteorites, cosmic ray tracks, chondrites, compositions, parent bodies, stony meteorites, asteroids, tektites, achondrites, lunar rocks and bulk analysis.

64582 Proceedings of the Conference on Nonlinear Fluid Behavior.
Physica A (Netherlands), vol.118A, no.1-3 (March 1983).
Conference held at: Boulder, CO, USA. Date 7-11 June 1982. The following topics were dealt with: non-Newtonian behaviour of polymeric liquids; kinetic theory of non-equilibrium fluids; molecular dynamics simulations of the rheological properties of simple fluids; Brownian motion effect on the transport of properties of a suspension of spherical particles; computer simulation; light scattering; continuum theory; turbulence; higher order equations of hydrodynamics; steady state thermodynamics and spatial correlations; fast pressure quenches near the critical point of a binary liquid mixture; a solvable weak-potential model of a non-Newtonian fluid; long time tail conundrum in non-equilibrium statistical mechanics; and catastrophic changes in tagged particle dynamics by the self-consistent repeated ring equation. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64583 Symposium on Probing the Earth's Lithosphere by Controlled Source Seismology.
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4 (April 1983).
Conference held at: London, Ont., Canada. Date 22-23 July 1981. The subject matter of the papers was divided into three broad headings: (1) continental lithosphere, (2) deep seismic reflection studies, and (3) lithosphere of oceanic regions and margins. In the session on the continental lithosphere, the results of a number of medium- to long-range refraction experiments carried out in North America, Europe, Asia and Africa were presented. It also included papers in which interpretational techniques were discussed. In the session on deep seismic reflection studies the results of both Vibroseis- and explosion-type reflection experiments were described in detail, with emphasis on the identification of detailed lateral variations in structure across various regions of geological interest. A series of papers was presented in the session on the lithosphere of oceanic regions and margins including structures such as the East Pacific Rise, the Azores-Biscay Rise, subduction zones of South America and New Zealand, as well as studies of the lower lithosphere in the north western Pacific Ocean. This special issue of Physics of the Earth and Planetary Interiors presents ten selected papers. 29 papers were presented, of which 10 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this and other issues.

64584 Fifth International Symposium on Solar-Terrestrial Physics.
Space Sci. Rev. (Netherlands), vol.34, no.1 (Jan. 1983).
Conference held at: Ottawa, Canada. Date 17-22 May 1982. Sponsors: COSPAR; IAU; IUGG; et al. Several solar topics were discussed, including: solar coronal disturbances, the solar cycle, electrodynamics of the outer solar atmosphere, preflare magnetic fields. Other papers describe the solar wind, interplanetary disturbances, interplanetary cosmic ray propagation and solar wind shock waves. Some of the papers describe the interaction of the solar wind with the Earth's magnetosphere. Another group of papers decribe magnetospheric topics. Magnetosphere-ionosphere interactions are described. The last section of the conference is about the neutral atmosphere. 31 papers were presented and are published in full. Abstracts of individual papers can be found under the relevant classification in this and other issues.

64585 Conference on the Processes of Planetary Rifting.
Tectonophysics (Netherlands), vol.94, no.1-4 (1983).
Conference held at: St. Helena, CA, USA. Date 3-5 Dec. 1981. Sponsors: American Geophys. Union; Lunar & Planetary Inst.; NASA; NSF. The following topics were dealt with: Graben formation, rifts, swells, uplift, lithosphere convective thinning, volcanism, Earth, Venus, Mars, mid-ocean ridges, hotspot tracks, cratonic basins, pulsation tectonics, continental margin breakup, gravity, Africa, heat flow, Kenya, magnetotelluric results, crust structure, United States, seismic refraction, geochemistry, orogeny, stress, surface deformation and geothermal resources.

64586 Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium).
Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale (1982), 2 vol. xxiv+1043+xv+415 pp.
Conference held at: Toulouse, France. Date 13-17 Sept. 1982. The following topics were dealt with: microwave, visible and IR data enhancement and thematic classification, spectral signatures of objects, renewable resources,. nonrenewable resources, environmental monitoring, oceanography and coastal zone, ice and snow cover, land use and cover, engineering projects remote sensing, industrial processes, vegetation damage, agriculture, forestry and satellite remote sensing programs.

64587 Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region.
Lund, Sweden: Univ. Lund (1982), 2 vol. 281 pp.
Conference held at: Lund, Sweden. Date 5-7 Oct. 1982. The goal of the workshop was to discuss how the new generation of electron accelerator systems and rings with high current and high duty-cycle can be used to improve our understanding of nuclear structure and nuclear reactions and what demands this new experimental situation puts on targets and detectors. The main topics were: (i) stretcher rings and related experiments; (ii) storage rings and related experiments; and (iii) intermediate energy physics. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64588 8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems.
Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart (1982), 516 pp.
Conference held at: Stuttgart, Germany. Date 14-15 Oct. 1982. The following topics were dealt with: structural mechanics, fracture and fatigue nondestructive testing in materials for LWR and advanced reactor systems.

64589 Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics.
LaGrange Park, IL, USA: ANS (1982), xiv+1525 pp. [0 89448 110 X]
Conference held at: Santa Barbara, CA, USA. Date 11-14 Jan. 1983. Sponsors: ANS; ASME; AIChE. The following topics were dealt with: two-phase hydrodynamics, heat transfer aspects of nuclear thermal-hydraulics, mathematical methods in nuclear thermal-hydraulics, simulators and analysis of reactor transients, loss of coolant accidents, fluid-structure interaction, natural circulation in water and gas cooled reactors, thermal hydraulics of degraded cores, behaviour of containment systems, hydrogen behaviour in containment, thermal hydraulics of LMFBRs, reactor instrumentation. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64590 Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82).
Stockholm, Sweden: ASEA (1982), 274 pp.
Conference held at: Odense, Denmark. Date 1982. The following topics were dealt with: electric discharges at insulation interfaces; microscopic phenomena at interfaces; high-voltage tracking; materials testing; partial discharges; high-voltage technology and insulation coordination. 24 papers were presented, and are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64591 Proceedings of the 21st Annual Conference of the Electron Microscopy Society of Southern Africa.
Johannesburg, South Africa: Electron Microscopy Soc. Southern Africa (1982), vii+116 pp. [0 620 01543 8]
Conference held at: Grahamstown, South Africa. Date 1-3 Dec. 1982. The following topics were dealt with: techniques and instrumentation in scanning and transmission electron microscopy; the application of electron microscopy to biological and medical sciences, electron microscopy applications in solid state physics.

64592 In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV).
North-Holland: New York, USA (1982), xii+343 pp. [0 444 00726 1]
Conference held at: Boston, MA, USA. Date 16-19 Nov. 1981. The following topics were dealt with: high temperature structural eutectic alloys; eutectic superalloys; mechanical properties; directionally solidified composites; microstructure. 30 papers were presented, of which 28 are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64593 Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste.
New York, USA: North-Holland (1982), xiv+905 pp. [0 444 00725 3]
Conference held at: Berlin, Germany. Date 7-10 June 1982. The following topics were dealt with: nuclear waste management; high level radioactive waste forms; glass reactions with aqueous media; glass mechanical properties; ceramics; waste repository characterisation; salt repositories; rock repositories; backfill materials; canister corrosion; nuclide migration in geosphere; LLW in-situ solidification; MLW in-situ solidification. 98 papers were presented, 91 of which are published in full in the present proceedings. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64594 Workshop on SPS Fixed-Target Physics in the Years 1984-1989 (CERN-83-02).
Geneva, Switzerland: CERN (1983), vii+192 pp.
Conference held at: Geneva, Switzerland. Date 6-10 Dec. 1982. A Workshop on SPS Fixed Target Physics in the Years 1984-89 was held at CERN during the week 6-10 December 1982 and was attended by more than 400 physicists. The introductory remarks by H. Schopper, Director-General of CERN, together with the contributions of K. Stanfield and T. Yamanouchi on the FNAL scientific programme and plans, and with the summary talks of the conveners of the five sessions related to the main topics of the Workshop, are contained in this first volume of the Proceedings. An attempt has been made to include the discussion contributions for the concluding day of the Workshop.

64595 Proceedings: Thermal Reactor Benchmark Calculations, Techniques, Results, and Applications (EPRI-NP-2855) (papers in summary form only received).
Palo Alto, CA, USA: EPRI (1983), 696 pp.
Conference held at: Upton, NJ, USA. Date 17-18 May 1982. This report contains the proceedings of an EPRI-sponsored symposium held on May 17-18, 1982, at the Brookhaven National Laboratory in New York, to discuss thermal reactor benchmark calculations, techniques, results, and applications. Third in a series of workshops on problems associated with nuclear data use and confirmation of LWR analysis, this conference addressed the concern about nuclear data and methods that have been used for analyzing or predicting reactor behavior. Areas where measurements have been productive and where additional improvements can be made are studied.

64596 Colloquium on 'Saw Devices'.
London, England: IEE (1983), 58 pp.
Conference held at: London, England. Date 23 Feb. 1983. Outlines the theory and practical aspects of SAW devices and their uses in signal processing. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64597 Colloquium on 'High Temperature Electronics'.
London, England: IEE (1983), 40 pp.
Conference held at: London, England. Date 23 March 1983. The following topics were dealt with: electronic systems; resistance thermometry; power supply design; photomultipliers; geophysical techniques; nuclear reactor instrumentation; pyrometry. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

64598 Proceedings of the VI High Energy Physics Symposium (papers in summary form only received).
Bombay, India: Dept. Atomic Energy (1982), 146 pp.
Conference held at: Mysore, India. Date 6-11 Dec. 1982. The following topics were dealt with: left-right asymmetry in GUT's, n-n̄ oscillations, quark models in SU(n), SO(n) models, particle mass scales, proton decay, quark jets, deep inelastic processes, magnetic moments, chiral symmetries, charmed particles, baryon-nucleon reactions, meson-nucleon reactions, e^+e^- annihilation, experimental techniques. Abstracts of individual papers can be found under the relevant classification codes in this or other issues.

01.30K Handbooks, dictionaries, tables and data compilation

64599 Compilation of coupling constants and low-energy parameters: 1982 edition. O.Dumbrajs, R.Koch, H.Pilkuhn (Univ. of Karlsruhe, Karlsruhe, Germany), G.C.Oades, H.Behrens, J.J.De Swart.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.277-335 (2 May 1983).
The work is an updating of the previous compilation by Nagels (1979). The authors have adopted as much as possible the connections of Bjorken (1964), Gasiorowicz (1966), and Pilkuhn (1979). They have omitted the sections on YN scattering and Regge residues and a section on QCD has been added. (240 refs.)

64600 Behaviour of the AB_2 type compounds at high pressures and high temperatures. L.Merrill (Dept. of Chem., Brigham Young Univ., Provo, UT, USA).
J. Phys. & Chem. Ref. Data (USA), vol.11, no.4, p.1005-64 (1982).
Data on the polymorphic phase transformations of known compounds and new synthetic compounds of the type AB_2 have been compiled and evaluated. All available pressure studies have been included and referenced. Pressure-temperature phase diagrams showing first order solid-solid phase boundaries and/or melting curves showing the best fit to the experimental data are included. For some materials which can be produced only by chemical synthesis techniques at high pressures and high temperatures, reaction-product diagrams have been employed to estimate the region of thermodynamic stability. Crystallographic data of all the known phases of each material have been tabulated and evaluated. This review covers 168 compounds and 332 phases including the room temperature atmospheric pressure phase for each compound when it exists. (278 refs.)

64601 Heat capacity and other thermodynamic properties of linear macromolecules. VI. Acrylic polymers. U.Gaur, S.Lau, B.B.Wunderlich, B.Wunderlich (Dept. of Chem., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Phys. & Chem. Ref. Data (USA), vol.11, no.4, p.1065-89 (1982).
For pt.V see ibid., vol.11, p.313 (1982). Heat capacity of poly(methyl methacrylate), polyacrylonitrile, poly(methyl acrylate), poly(ethyl acrylate), poly(n-butyl acrylate), poly(iso-butyl acrylate), poly(octadecyl acrylate), poly(methacrylic acid), poly(ethyl methacrylate), poly(n-butyl methacrylate), poly(iso-butyl methacrylate), poly(hexyl methacrylate), poly(dodecyl methacrylate), poly(octadecyl methacrylate) and polymethacrylamide is reviewed on the basis of measurements of 35 samples reported in the literature. A set of recommended data are derived for each acrylic polymer in the amorphous state. Enthalpy and entropy functions are calculated for poly(methyl methacrylate) and polyacrylonitrile. This is the sixth paper in a series of publications which will ultimately cover all heat capacity measurements on linear macromolecules. (56 refs.)

64602 Molecular form factors and photon coherent scattering cross sections of water. L.R.M.Morin.
J. Phys. & Chem. Ref. Data (USA), vol.11, no.4, p.1091-8 (1982).
Tabulations are presented of molecular form factors $F(x)$, for values of $x=\sin(\theta/2)/\lambda$ from 0 to 1.25 $\mathrm{\AA}^{-1}$, for liquid water at eight temperatures between 4°C and 200°C and for the free water molecule. For liquid water, $x=0$ to 1.25 $\mathrm{\AA}^{-1}$, the tabulated values are interpolated from experimental values of Narten and Levy (1971). For the free water molecule, $x=0$ to 1.25 $\mathrm{\AA}^{-1}$, the tabulated values are interpolated from calculated values of Blum (1971). For $x=1.25$ to 10^9 $\mathrm{\AA}^{-1}$, the independent atomic scattering hypothesis is assumed and the water molecular form factor $F(x)$ is calculated from the hydrogen and oxygen atomic form factors given by Hubbell and Overbo (1979). Tables of coherent scattering cross sections, obtained by numerical integration of the Thomson formula, weighted by $F^2(x)$, are presented for liquid water at eight temperatures between 4°C and 200°C and for the free water molecule, for photon energies 5 keV to 1 MeV. (12 refs.)

64603 Evaluation of binary *PTxy* vapor-liquid equilibrium data for C_6 hydrocarbons. Benzene+cyclohexane. D.B.Smith, O.Muthu, A.Dewan, M.Gierlach (Thermodynamics Res. Lab., Washington Univ., St. Louis, MO, USA).
J. Phys. & Chem. Ref. Data (USA), vol.11, no.4, p.1099-126 (1982).
The methods used to evaluate subcritical binary *PTxy* vapor-liquid equilibrium data are described. The evaluation results for the benzene+cyclohexane system are presented. The needs for new experimental data are defined. (3 refs.)

64604 Evaluation of binary excess enthalpy data for C_6 hydrocarbons. Benzene+cyclohexane. B.D.Smith, O.Muthu, A.Dewan, M.Gierlach (Thermodynamics Res. Lab., Washington Univ., St. Louis, MO, USA).
J. Phys. & Chem. Ref. Data (USA), vol.11, no.4, p.1127-49 (1982).
The methods used to evaluate excess enthalpy data are described. The evaluation results for the benzene+cyclohexane system are presented. The needs for new experimental data are defined. (3 refs.)

64605 Evaluation of binary excess volume data for C_6 hydrocarbons. Benzene+cyclohexane. B.D.Smith, O.Muthu, A.Dewan, M.Gierlach (Thermodynamics Res. Lab., Washington Univ., St. Louis, MO, USA).
J. Phys. & Chem. Ref. Data (USA), vol.11, no.4, p.1151-69 (1982).
The methods used to evaluate excess volume data are described. The evaluation results for the benzene+cyclohexane system are presented. The needs for new experimental data are defined. (6 refs.)

01.30M Textbooks for graduates and researchers

64606 Progress in boundary element methods. Vol.2. C.A.Brebbia [Ed.]
Plymouth, England: Pentech Press (1983), 217 pp. [0 7273 1611 7]
Volume 2 of the series brings together a new range of applications of boundary element methods (BEM). The book is divided into eight chapters dealing with: nonlinear potential problems; wave propagation phenomena; fracture mechanics stress analysis; linear isotropic elasticity with body forces; the boundary element method applied to two-dimensional contact problems; boundary integral equations for bending of thin plates; fluid structure interaction; and viscoplasticity and creep using boundary elements.

01.30R Surveys and tutorial papers; resource letters

Dynamics of nonlinear dissipative oscillators .... See Entry 64618

Effects of double passage of waves in randomly inhomogeneous media .... See Entry 64703

The gauge treatment of gravity .... See Entry 64812

Determination of the fine structure constant using MOS devices .... See Entry 64877

Measurement of long radius of curvature .... See Entry 64882

Polarization spectroscopy of gaseous media by the photon-echo method .... See Entry 64957

Canon T50. A report .... See Entry 64968

Dibaryon resonances .... See Entry 65162

Experimental fission barriers in heavy nuclei .... See Entry 65297

A review of flow-induced vibrations in reactors and reactor components .... See Entry 65312

Materials research for the Canadian nuclear fuel waste management program .. See Entry 65441

BWR loss of coolant technology review .... See Entry 65496

A review of current heat transfer correlations used in reactor safety assessment .... See Entry 65497

Detailed modelling of two phase flow and its application to system prediction . See Entry 65498

Degraded core heat transfer .... See Entry 65499

Condensation effects in reactor transients .... See Entry 65500

Lessons in reactor thermal-hydraulics from operating plant transients .... See Entry 65501

A review of flow-induced vibrations in reactors and reactor components .... See Entry 65502

Applied mathematical methods in nuclear thermal-hydraulics ..See Entry 65503

Flammability behaviour and pressure development of hydrogen mixtures in containment volumes .... See Entry 65581

Thermal-hydraulics of valves for nuclear applications .... See Entry 65582

Irradiation creep in the fusion reactor first wall .... See Entry 65666

Polarised targets—what is happening .... See Entry 65746

Quantum-chemical calculation of NMR chemical shifts .... See Entry 66028

Atomic collisions in the presence of strong radiation fields: an introductory survey .... See Entry 66094

Electron energy spectrum in low-energy collisions of negative ions and atoms .. See Entry 66120

Electron capture into excited states in collisions of highly charged ions with atoms: a theoretical and experimental challenge .... See Entry 66123

Fast beam radiofrequency spectroscopy .... See Entry 66149

Holography, coherent light amplification and optical phase conjugation with photorefractive materials .... See Entry 66240

Superradiance: an essay on the theory of collective spontaneous emission .... See Entry 66247

Theory of the spectrum of the quantised light field .... See Entry 66248

Free-electron lasers and their applications .... See Entry 66287

Current state of experimental studies of resonance media by the photon-echo method .... See Entry 66346

Coherent phenomena during the interaction between light pulses and resonance media .... See Entry 66347

Light echo in gases .... See Entry 66348

Nonlinear quantum acoustics .... See Entry 66421

Progress in computational physics .... See Entry 66547

Non-Newtonian behavior of polymeric liquids .... See Entry 66599

Molecular dynamics simulations of the rheological properties of simple fluids .. See Entry 66600

Similarities and differences in the nonlinear flow behavior of simple and of molecular liquids .... See Entry 66601

Explosion-driven shock tubes (review) .... See Entry 66650

Linear theory of a cold bounded plasma .... See Entry 66674

Lower hybrid additional heating for toroidal plasmas .... See Entry 66718

Kinetic theory of non-equilibrium fluid .... See Entry 66794

Electromagnetic radiation of relativistic channeling particles (the Kumakhov effect) .... See Entry 67082

On diffuse phase transitions and hybrid crystal formation .... See Entry 67159

Properties of metal hydrides. II .... See Entry 67266

Recent advances in the LB film studies .... See Entry 67316

Magnetoresistance in weakly localized regime .... See Entry 67655

Films and surfaces of ferromagnetic superconductors .... See Entry 67849

Unusual paramagnetism of FeSi: experiment .... See Entry 67889

Unusual paramagnetism of FeSi: theory .... See Entry 67890

Electron spin polarized tunneling study of ferromagnetic thin films .... See Entry 67972

Ferroelectromagnets .... See Entry 68133

Characters of local dynamics and local structure inferred from far infra red spectroscopy .... See Entry 68192

Photoemission from MBE grown III-V surfaces and interfaces .... See Entry 68406

Superplasticity: a review of data .... See Entry 68589

Low temperature fatigue fracture of metals and alloys .... See Entry 68640

Formation, transformation and dissolution of phases formed on surfaces .... See Entry 68680

Electrochemical measurements in flowing solutions .... See Entry 68700

Impact testing of fibre reinforced composite materials .... See Entry 68750

Properties of small metal particles .... See Entry 68801

Gas mixing within the acinus of the lung .... See Entry 68955

Overview of computerized tomography with emphasis on future developments ... See Entry 69014

Reconstruction algorithms: transform methods .... See Entry 69016

Status and prospects of the production of radioisotope-tagged compounds in the USSR .... See Entry 69024

Display of 3D information in discrete 3D scenes produced by computerized tomography .... See Entry 69045

Arterial tonometry: review and analysis .... See Entry 69080

Short review and recent results on microseisms .... See Entry 69123

Studies of the continental crust by near-vertical reflection methods: a review ... See Entry 69133

Current progress and prospects in numerical techniques for weather prediction models .... See Entry 69298

Analysis of palaeomagnetic time series—techniques and applications .... See Entry 69369

Review of archaeointensity methods .... See Entry 69370

Cosmology and elementary particles .... See Entry 69761

01.30T Bibliographies

Short review and recent results on microseisms .... See Entry 69123

Analysis of palaeomagnetic time series—techniques and applications .... See Entry 69369

01.40 EDUCATION

64607 Teaching neutron diffusion theory. J.D.Lewins.
Nucl. Eng. (GB), vol.24, no.2, p.44-8 (March-April 1983).
This note arises from experiences of teaching neutron diffusion theory to engineering students where there is neither the time, nor perhaps the inclination, to explore the underlying disciplines of neutron transport theory. The author's concern has been to introduce the model and equations in the most effective way and this note covers two or three points that have arisen in the context of developing the equations of the one-group neutron diffusion approximation. (4 refs.)

01.50 EDUCATIONAL AIDS

64608 Second quantization in nonrelativistic quantum mechanics. D.H.Kobe (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
Am. J. Phys. (USA), vol.51, no.4, p.312-15 (April 1983).
Second quantization in nonrelativistic quantum mechanics is given in a simplified way using eigenstates of the number operator. The field creation operator is shown to be the operator which adds a particle with a delta-function wave function to the system, while the field annihilation operator removes a particle with a delta-function wave function from the system. The field creation operator is proved to be the Hermitian conjugate of the annihilation operator. The communication (anticommutation) relations for boson (fermion) field operators are proved from the symmetry (antisymmetry) of the many-particle wave function. The second quantized form of one- and two-particle operators is obtained from their form in wave mechanics using the definition of the field creation and annihilation operators. (12 refs.)

64609 Double-exposure speckle photography for the measurement of small displacements. E.S.Wu, D.B.Geohegan (Dept. of Phys., Univ. of Maryland, Baltimore, MD, USA).
Am. J. Phys. (USA), vol.51, no.4, p.315-20 (April 1983).
The method of double-exposure speckle photography (DESP) has been illustrated in experiments to determine the small displacements of a solid object. The object was illuminated by laser light and the speckle pattern was photographed on a stationary photographic film twice, once before and once after the object was displaced. The doubly exposed film, after being photographically processed, was illuminated by laser light to produce equally spaced Young's interference fringes on the Fraunhofer diffraction plane. From the spacing and the orientation of these fringes, both the magnitude and the direction of the displacement were determined. The authors have used the DESP method to measure the small length change of a cadmium tube due to thermal expansion and determined the linear thermal expansion coefficient of cadmium. (9 refs.)

64610 Instrumenting an *e/m* experiment for use in large enrollment courses. F.C.Peterson (Dept. of Phys., Iowa State Univ., Ames, IA, USA).
Am. J. Phys. (USA), vol.51, no.4, p.320-2 (April 1983).
In order to better meet the needs of a large enrollment introductory physics laboratory various accessories for a commercially available *e/m* apparatus have been designed and constructed. The purpose, details, and use of these accessories are described. (6 refs.)

64611 How can a particle absorb more than the light incident on it?. C.F.Bohren (Dept. of Meteorology, Pennsylvania State Univ., University Park, PA, USA).
Am. J. Phys. (USA), vol.51, no.4, p.323-7 (April 1983).
A particle can indeed absorb more than the light incident on it. Metallic particles at ultraviolet frequencies are one class of such particles and insulating particles at infrared frequencies are another. In the former strong absorption is associated with excitation of surface plasmons; in the latter it is associated with excitation of surface phonons. In both instances the target area a particle presents to incident light can be much greater than its geometrical cross-sectional area. This is strikingly evident from the field lines of the Poynting vector in the vicinity of a small sphere illuminated by a plane wave. (14 refs.)

64612 Comment on 'How can a particle absorb more than the light incident on it?'. H.Paul, R.Fischer (Zentralinst. fur Optik & Spektroskopie, Akad. der Wissenschaften, Berlin, Germany).
Am. J. Phys. (USA), vol.51, no.4, p.327 (April 1983).
Independently of the work by C.F. Bohren (1983), the authors investigated the same problem, however, on the atomic scale. Specifically, they considered

the following physical picture: In the presence of an intense (plane-wave-type) coherent resonant monochromatic electromagnetic field, an atom, being initially nonexcited, acquires an electric dipole moment—in the sense of the quantum-mechanical expectation value. This dipole moment, oscillating at the frequency of the incident field, according to classical electrodynamics emits a wave which interferes with the incoming wave. The authors found that the energy flux lines in the superposition field are bent, in a rather large neighborhood of the atom, in such a way as to direct energy into the atom. In fact, the corresponding curves in the x,z plane are very similar to those presented by Bohren (1983). In contrast to his paper, the authors had to deal with a transient phenomenon—the absorption process being finished when the atom has taken up the energy of a single photon. Physically, the essential difference between the results and that of Bohren is that they found the effective absorption cross section of an atom to decrease with growing intensity of the incident field as the inverse of the field amplitude, while the corresponding quantity for a macroscopic particle (with dimensions still small compared with the wavelength) proved to be independent of the field. From the authors study, it becomes evident that the wave picture quite naturally accounts for the well-known large effective absorption cross sections, compared to the geometrical ones, of atomic systems, while the particle picture certainly fails to do so. (2 refs.)

64613 The physics behind path integrals in quantum mechanics. P.D.Mannheim (Dept. of Phys., Univ. of Connecticut, Storrs, CT, USA).
Am. J. Phys. (USA), vol.51, no.4, p.328-34 (April 1983).
Presents a simple pedagogical discussion of the physics of path integrals in nonrelativistic quantum mechanics. Rather than show that the path integral gives the standard results of quantum mechanics, as is usually done in the literature, the author instead discuss why it does so. Specifically, the author discusses why the phase factor associated with each path is given by the classical action. The author constructs the path integral using Huygens's principle. Finally, it is shown that the existence of many paths is a consequence of the spreading of the quantum-mechanical wave function. (7 refs.)

64614 Testing laboratory performance. G.Theysohn, H.-J.Jodl (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
Am. J. Phys. (USA), vol.51, no.4, p.334-8 (April 1983).
A practical test seems to be a more adequate test type for measuring laboratory achievement than written or oral tests, for it is constructed specifically to examine outcomes in laboratory objectives, which can roughly be described as experimental skills. Several suggestions from various authors are reviewed. Their methods are discussed, and an improved way of testing experimental abilities is proposed. It is shown that under certain conditions performance tests may be highly reliable instruments. (24 refs.)

64615 Generalized Fermat principle. W.A.Newcomb (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Am. J. Phys. (USA), vol.51, no.4, p.338-40 (April 1983).
Fermat's principle of least time in geometrical optics is shown to be applicable not only in the usual case of an isotropic medium but also for a general medium of arbitrary anisotropy. (9 refs.)

64616 Spectra of electronic noise signals: A microcomputer experiment. R.E.Jodoin, W.Irish (Dept. of Phys., Rochester Inst. of Technol., Rochester, NY, USA).
Am. J. Phys. (USA), vol.51, no.4, p.340-4 (April 1983).
The authors designed an advanced undergraduate experiment which interfaces a microcomputer to collect samples of noise signals. The data are stored and analyzed for their power spectra. The analysis uses the concepts of autocorrelation and the discrete Fourier transform, and the results are automatically plotted and compared to what is expected. Advantages and limitations of the microcomputer are discussed. (4 refs.)

64617 A constant force generator for the demonstration of Newton's second law. F.Herrmann, T.Muhlbayer (Inst. fur Didaktik der Phys., Univ. Karlsruhe, Karlsruhe, W Germany).
Am. J. Phys. (USA), vol.51, no.4, p.344-6 (April 1983).
A constant force generator is very helpful in demonstrating Newton's second law in the classroom. A device is described which avoids the disadvantages of setups currently used. It is based upon the induction of eddy currents. It is easy to handle and can be self-made. (no refs.)

64618 Dynamics of nonlinear dissipative oscillators. P.Hanggi, P.Riseborough (Dept. of Phys., Polytech. Inst. of New York, New York, NY, USA).
Am. J. Phys. (USA), vol.51, no.4, p.347-52 (April 1983).
The authors review some of the important concepts and theorems dealing with nonlinear dissipative oscillators in the presence of random and deterministic periodic forces, with particular reference to the Van der Pol oscillator. The authors display simple techniques such as the Krylov-Bogoliubov averaging method and generalize this method to random oscillator systems exhibiting new noise-induced phenomena. (24 refs.)

64619 Aristotle is not dead: student understanding of trajectory motion. R.J.Whitaker (Dept. of Phys., Southwest Missouri State Univ., Springfield, MO, USA).
Am. J. Phys. (USA), vol.51, no.4, p.352-7 (April 1983).
The study of motion presents problems to students of beginning physics at all levels. Part of this problem arises because of students' 'common sense' ideas of motion. Six questions on trajectory motion, based on Galileo's 'thought experiments' in his Dialogue Concerning the Two Chief World Systems, were given to students in several different introductory physics classes. These responses are analyzed and discussed. (16 refs.)

64620 Maximum projectile range with drag and lift, with particular application to golf. H.Erlichson (Dept. of Appl. Sci., The Coll. of Staten Island, New York, NY, USA).
Am. J. Phys. (USA), vol.51, no.4, p.357-62 (April 1983).
This paper explores the interesting problem of projectile motion without the vacuum idealization. Particular attention is paid to golf ball trajectories with and without lift. No lift trajectories with linear and quadratic drag are considered first. Then, trajectories with lift and linear drag are investigated. Projection angles for maximum range are determined for all these cases. Computer solutions are used throughout, with a Runge-Kutta routine used for all cases except for the well-known closed solution for the no lift, linear drag projectile. (15 refs.)

64621 Latent heat and low-temperature heat capacity experiment for the general physics laboratory. C.W.Tompson, H.W.White (Dept. of Phys., Univ. of Missouri, Columbia, MO, USA).
Am. J. Phys. (USA), vol.51, no.4, p.362-4 (April 1983).
An experiment to measure the latent heat of vaporization of liquid nitrogen and the average heat capacities at constant pressure of several materials in the temperature range 77-295K is described. This exercise uses normally available laboratory apparatus and is suitable for the general physics laboratory. (2 refs.)

64622 Remark on the isotropic form of the Schwarzschild interior metric. H.A.Buchdahl (Dept. of Theoretical Phys., Australian Nat. Univ., Canberra, Australia).
Am. J. Phys. (USA), vol.51, no.4, p.364-6 (April 1983).
In the course of determining the Scharzschild interior solution in isotropic coordinates it turns out that to a given density and coordinate radius there in general correspond two possible spheres which have distinct masses and distinct physical radii. This situation is here described in detail. (18 refs.)

64623 Electronic Cavendish device. R.E.Crandall (Dept. of Phys., Reed Coll., Portland, OR, USA).
Am. J. Phys. (USA), vol.51, no.4, p.367-8 (April 1983).
The Cavendish torsion-balance method of detecting gravitational forces, while elegant and highly educational, is difficult to arrange as a lecture demonstration. The chief reason for this is the large settling time for torque-induced rotation. Described here is an apparatus in which the torsion bar does not appreciably rotate. A simple electronic servomechanism is used to maintain rotational equilibrium as an external mass is introduced. The resulting servo correction voltage is proportional to the torque induced by gravity. This effect can be observed in tens of seconds. (1 ref.)

64624 Illustrative examples of the symplectic group. Y.S.Kim (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA), M.E.Noz.
Am. J. Phys. (USA), vol.51, no.4, p.368-75 (April 1983).
Simple illustrative examples are given for understanding the symplectic group. Transformation properties of the Sp(2) group are discussed in terms of the two-dimensional geometry of circles and ellipses, two-by-two matrices, and in terms of a group-theoretical language similar to that of the Pauli spin matrices. The isomorphism between the Sp(2) and SO(2,1) groups is discussed in detail. It is noted that this isomorphism is similar to that between the SU(2) and rotation groups. Simple illustrative physical examples are given also for using the symplectic group in nuclear physics, statistical mechanics, and in high-energy physics. (40 refs.)

64625 A new parametrization of the rotation matrix. E.Pina (Dept. of Phys., Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Am. J. Phys. (USA), vol.51, no.4, p.375-9 (April 1983).
A new parametrization of the rotation matrix is presented assuming it is known that this matrix transforms a particular vector into another vector. The matrix is expressed as a function of these vectors and of an angle which measures the deviation from the shortest possible rotation. Some applications of this representation to dynamics are also explained. (9 refs.)

64626 Three-dimensional interference-diffraction patterns. D.D.Long, L.C.Bolling (Dept. of Phys., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Am. J. Phys. (USA), vol.51, no.4, p.380-1 (April 1983).
The demonstration the authors describe shows that the light emerges from the slit(s) in a three-dimensional pattern that actually consists of separated beams. The demonstration consists of sending the diffracted light through a smoke-filled transparent box so that the interference-diffraction patterns are visible in three dimensions via the light scattered by smoke particles within the box. Two conditions must be met if the pattern is to be seen throughout the classroom. (1) The box must be far enough from the laser and slits that the fringes are well separated. A distance of several meters is usually convenient. (2) For a low-power laser ($\sim$1 mW), the scattered light must be viewed from near the forward direction if its intensity is to be high enough to make the pattern visible. (5 refs.)

64627 A simple model of a Feshbach resonance. P.A.Fraser (Dept. of Appl. Maths., Univ. of Western Ontario, London, Canada), S.K.Burley.
Eur. J. Phys. (GB), vol.3, no.4, p.230-8 (1982).
A simple model, suitable for student calculation and exploration, that gives rise to a closed channel or Feshbach resonance is described. The model involves delta-function shell potentials. A range of illustrative examples is presented. (4 refs.)

64628 Model experiment illustrating sedimentation by microcomputer. H.Minowa (Phys. Dept., Numazu Nat. Coll. of Technol., Numazu-shi, Shizuoka, Japan), D.Toya, N.Mishima.
Eur. J. Phys. (GB), vol.3, no.4, p.239-44 (1982).
Gives a model experiment by microcomputer on the sedimentation phenomenon in brownian motion. The simulation is performed by utilising the model of two-dimensional Brownian motion developed in a previous paper. The results can be compared with the exact analytical solution of the Smoluchowski equation and with its numerical calculations. Through these works the sedimentation of Brownian particles has become an interesting and educational subject in the undergraduate physics course. (6 refs.)

64629 Physics for architects. E.M.Anastassakis (Phys. Dept., Nat. Tech. Univ., Athens, Greece).
Eur. J. Phys. (GB), vol.3, no.4, p.247-9 (1982).
The structure of a one-semester physics course for architects is described. It has been designed and intended to serve the architecture student as an engineer, an artist and a concerned individual. (8 refs.)

64630 The calculation of potential energy curves of diatomic molecules: the RKR method. F.Castano, J.de Juan, E.Martinez (Dept. de Quimica Fisica, Facultad de Ciencias, Univ. del Pais Vasco, Bilbao, Spain).
J. Chem. Educ. (USA), vol.60, no.2, p.91-3 (Feb. 1983).
Both procedures (Morse and RKR) are compared for the spectroscopically well-known $I_2(X^1\Sigma_g^+)$ state. (19 refs.)

64631 Degas' dancers: an illustration for rotational isomers. I.Hargittai (Acad. of Sci., Budapest, Hungary).
J. Chem. Educ. (USA), vol.60, no.2, p.94 (Feb. 1983).
Two drawings by Degas—'End of the Arabesque' and 'Seated Dancer Adjusting Her Shoes'—provide an opportunity to introduce the concepts of staggered and eclipsed conformations of A_2B-BC_2 molecules in a concrete, interesting (and aesthetic) way. (no refs.)

64632 Correct representation of conformational equilibria. F.Fulop, G.Bernath (Inst. of Pharmaceutical Chem., Univ. Medical School, Szeged, Hungary), J.A.Szabo, Gy.Dombi.
J. Chem. Educ. (USA), vol.60, no.2, p.95 (Feb. 1983).
The problem is presented using the example of depicting the conformational equilibrium of 2-methyl-1-cyclohexanone, which has only one chiral carbon. (11 refs.)

64633 Deriving $S=k\ln\Omega$. M.P.Melrose (King's Coll., Univ. of London, London, England).
J. Chem. Educ. (USA), vol.60, no.2, p.106-8 (Feb. 1983).
The derivation presented makes what is possibly the minimum assumption for there to be a relationship between statistical mechanics and thermodynamics: that a system in statistical equilibrium is also in thermodynamic equilibrium. That is, when $\ln\Omega$ has attained a maximum value in an isolated system, all parts of the system which can interact thermally have the same temperatures as all parts which can interact mechanically have the same pressure. (5 refs.)

64634 The steady state and equilibrium assumptions in chemical kinetics. D.C.Tardy, E.D.Cater (Univ. of Iowa, Iowa City, IA, USA).
J. Chem. Educ. (USA), vol.60, no.2, p.109-11 (Feb. 1983).
Two approximation methods are often used in obtaining the desired rate law: (a) steady state approximation, and (b) equilibrium approximation. The authors delineate between the two approximations, and demonstrate the importance of making the equilibrium assumption at the appropriate step in the calculation. The ozone decomposition was chosen as the example because of the current interest in the ozone depletion problem, and because the elementary rate constants are known. They first discuss the principles, then show numerically how closely both approximations approach the exact case. (5 refs.)

64635 Relativistic effects on chemical properties. D.R.McKelvey (Indiana Univ. of Pennsylvania, Indiana, PA, USA).
J. Chem. Educ. (USA), vol.60, no.2, p.112-16 (Feb. 1983).
The author traces the development of the relativistic wave equation, the Dirac equation, starting with the Bohr treatment of the hydrogen atom. Relativistic effects are shown to be largely responsible for the chemical differences between the fifth and sixth row elements. Relativistic effects account for the 'inert pair' effect, contribute to the lanthanide contraction and are probably responsible for the unusual stability of Hg_2^{2+}. The author believes that the Dirac treatment and its consequences have a definite place in the undergraduate curriculum and should be receiving considerably more emphasis than they are given at present. (11 refs.)

64636 A simple theory to predict small changes in volume and refractivity during mixing of a two-component liquid system. T.M.Aminabhavi (Southwest Texas State Univ., San Marcos, TX, USA).
J. Chem. Educ. (USA), vol.60, no.2, p.117-18 (Feb. 1983).
Investigates the combined use of the two experimental parameters partial molar volumes and molar refractivities in the study of binary liquid mixtures. (4 refs.)

64637 Construction of lines of constant density and constant refractive index for ternary liquid mixtures. A.Z.Tasic, B.D.Djordjevic (Dept. of Chem. Engng., Faculty of Technol. & Metall., Univ. of Beograd, Beograd, Yugoslavia).
J. Chem. Educ. (USA), vol.60, no.2, p.118-20 (Feb. 1983).
Demonstrates the construction of density constant and refractive index constant lines in the triangular coordinate system on the basis of systematic experimental determinations of the density and the refractive index for both homogeneous (single-phase) ternary liquid mixtures (of a known composition) and the corresponding binary combinations. (no refs.)

64638 Computer programs for entrance examinations (by COBOL language). T.Kurata, Y.Saijo, S.Tagawa.
J. Fac. Eng. Chiba Univ. (Japan), vol.34, no.2, p.21-5 (1983). In Japanese.
The authors present computer programs for entrance examinations using COBOL. They compare these with previously written programs in FORTRAN. (1 ref.)

64639 Using interactive computer graphics for statistical education. T.Inoue (Faculty of Engng., Chiba Univ., Chiba, Japan), M.Yasuda, M.Hoshi, M.Taguri.
J. Fac. Eng. Chiba Univ. (Japan), vol.34, no.2, p.65-85 (1983).
A new development of CHESS (CHiba Eduational System for Statistics) is presented in view of the TSS graphic terminal, mainly written in FORTRAN. This is for benefit not only of the students but also of research members. (3 refs.)

64640 Demonstrations of some optical properties of liquid crystals. A.J.Nicastro (Dept. of Phys., Bucknell Univ., Lewisburg, PA, USA).
Phys. Teach. (USA), vol.21, no.3, p.181-2 (March 1983).
Experiments to demonstrate the existence of the liquid crystalline phase, the ordering of the long axes of molecules along one direction and the electro-optical effects in liquid crystal displays are briefly described. (no refs.)

64641 Energy flow in vapour boats. E.V.Garcia (Colegio de Ciencias y Humanidades, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico), E.B.Cabrera, R.Espejel, H.R.Riveros.
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.237-44 (Feb. 1983).
Two experiments are described, to be used in high school physics laboratory, based on very simple little vapour boats. The importance of these experiments lies in the opportunity, given to the student, to design the experiment, make the measurements and give an interpretation, all by himself; without disturbing the budget nor needing very complicated physical concepts. At the end the experimental values obtained and the procedure used are presented. (7 refs.)

64642 Visual training aids, set no.15: steel and cast-iron (crystalline) structures. J.Dejieux (Inst. de Soudure, Paris, France).
Souder (France), vol.4, no.2, p.37-40 (March 1982). In French. [received: March 1983]
Methods are described for producing micrographic slides of crystalline structures in steels and cast iron. Samples of metal are prepared for microscope by diamond paste polishing and etching with Nital to highlight perlite against ferrite and cementite. Other samples are then etched with boiling alkaline sodium picrate to highlight cementite. Twenty examples are shown. Slide sets are available from Soudure Autogene, 32 Boulevard de la Chapelle, 75880 Paris, Cedex 18. (no refs.) *A.E.W.*

01.55 GENERAL PHYSICS

64643 Interdisciplinary approaches in physics—the concepts. J.Vlachy.
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B32, no.11, p.1311-17 (1982).
Interdisciplinarity is one of the key words in science nowadays. Team work, cross-disciplinary and multidisciplinary co-operation have become other common expressions, almost slogans. The fringe areas are taken for the best factor of new integration processes in science, the candidates for major breakthroughs in knowledge and in understanding. World literature on interdisciplinarity has well surpassed the 2000-entry margin. Many of the documents deal with physics which makes a comprehensive review virtually impossible. The author tries to summarize and update older reports on interdisciplinary approaches in general and in physics research. (29 refs.)

01.65 HISTORY OF SCIENCE

64644 Early electrostatic accelerators and some later developments. R.G.Herb (Nat. Electrostatics Corp., Middleton, WI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1359-62 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The author describes the development of electrostatic accelerators from 1930 to the present situation. (no refs.)

01.70 PHILOSOPHY OF SCIENCE

64645 Probabilistic causality and the question of transitivity. E.Eells, E.Sober (Dept. of Philosophy, Univ. of Wisconsin, Madison, WI, USA).
Philos. Sci. (USA), vol.50, no.1, p.35-57 (March 1983).
After clarifying the probabilistic conception of causality suggested by Good (1961-2), Suppes (1970), Cartwright (1979), and Skyrms (1980), the authors prove a sufficient condition for transitivity of causal chains. The bearing of these considerations on the units of selection problem in evolutionary theory and on the Newcomb paradox in decision theory is then discussed. (25 refs.)

01.75 SCIENCE AND SOCIETY

64646 Conditions for the successful use of science. C.Carter.
Science (USA), vol.219, no.4590, p.1295-8 (18 March 1983).
There is ground for concern that the British research and development effort, which is of considerable size, may not be well distributed. In some areas of intense scientific effort, commercial priorities tend to be forgotten. Too many of the units of the economic system are backward in understanding what science can offer and inefficient in using the opportunities which it provides. Evidence suggests that the successful use of science depends of the overall quality of management rather than specifically on its degree of scientific knowledge. (8 refs.)

01.90 OTHER TOPICS OF GENERAL INTEREST

Review of archaeointensity methods .... See Entry 69370

02.00 MATHEMATICAL METHODS IN PHYSICS

02.10 ALGEBRA, SET THEORY, AND GRAPH THEORY

64647 Expression for y_{LM} [$(\mathbf{r}_1\wedge\mathbf{r}_2)\wedge\mathbf{r}_3$]. T.A.Antone (Dept. of Math., Ahmadu Bello Univ., Zaria, Nigeria).
J. Math. Phys. (USA), vol.24, no.5, p.1060-1 (May 1983).
The solid harmonic y_{LM} [$(\mathbf{r}_1\wedge\mathbf{r}_2)\wedge\mathbf{r}_3$] is expressed in terms of the spherical harmonics $Y(L_1M_2)(\hat{\mathbf{r}}_1)$, $Y(L_2M_2)(\hat{\mathbf{r}}_2)$, and $Y(L_3M_3)(\hat{\mathbf{r}}_3)$. The calculation of the coefficients in the given expansion in terms of $9-j$ symbols explicitly justifies the expanded form. (3 refs.)

64648 Superposition principles for matrix Riccati equations. J.Harnad, P.Winternitz (Centre de Recherche de Math. Appl., Univ. de Montreal, Montreal, Quebec, Canada), R.L.Anderson.
J. Math. Phys. (USA), vol.24, no.5, p.1062-72 (May 1983).
A superposition rule is obtained for the matrix Riccati equation (MRE) $\dot{W}=A+WB+CW+WDW$ [where $W(t)$, $A(t)$, $B(t)$, $C(t)$, and $D(t)$ are real $n\times n$ matrices], expressing the general solution in terms of five known solutions for all $n\geq 2$. The symplectic MRE ($W=W^T$, $A=A^T$, $D=D^T$, $C=B^T$) is treated separately, and a superposition rule is derived involving only four known solutions. For the 'unitary' and GL(n,**R**) subcases (with $D=A$ and $C=B^T$, or $D=-A$ and $C=B^T$, respectively), superposition rules are obtained involving only two solutions. The derivation of these results is based upon an interpretation of the MRE in terms of the action of the groups SL($2n$,**R**), SP($2n$,**R**), U(n), and GL(n,**R**) on the Grassman manifold $G_n(\mathbf{R}^{2n})$. (15 refs.)

A new parametrization of the rotation matrix .... See Entry 64625

An alternative proof of the representation theorem for isotropic, linear asymmetric stress-strain relations .... See Entry 64680

Solution of boundary-value problems by the *G*-polynomial method .... See Entry 64704

02.20 GROUP THEORY

(for algebraic methods in quantum mechanics, see 03.65; for symmetries in elementary particle physics, see 11.30)

64649 Weight multiplicity for Cartan classes. V.Amar, U.Dozzio, C.Oleari (Istituto di Fisica, Univ. di Parma, Parma, Itlay).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.201-9 (April 1983).
The important of simple Lie groups in physics is well known. This program computes the multiplicity of the dominant weights in a given irreducible representation of the Cartan classes $B(N)$,$C(N)$ and $D(N)$. (12 refs.)

64650 Harmonic polynomials invariant under a finite subgroup of O(n). A.Ronveaux (Dept. de Phys., Facultes Univ. Notre-Dame de la Paix, Namur, Belgium), Y.Saint-Aubin.
J. Math. Phys. (USA), vol.24, no.5, p.1037-40 (May 1983).
In this paper, an algorithm is described which allows a systematic computation of harmonic polynomials of a given degree invariant under a finite subgroup of the group O(n). An application of the algorithm to the octahedral (cubic) subgroup is given. (22 refs.)

Illustrative examples of the symplectic group .... See Entry 64624

Superposition principles for matrix Riccati equations .... See Entry 64648

The Casimir invariants and Gel'fand basis of the graded unitary group SU(m/n) .... See Entry 64720

Boson realisation of the Lie algebra F_4 and non-trivial zeros of 6*j* symbols .... See Entry 64721

Transfer matrices for one-dimensional potentials .... See Entry 64729

Path integrals in problems with boundaries .... See Entry 64759

On the relations between irreducible representations of the hyperoctahedral group and O(4) and SO(4) .... See Entry 64849

Nonscalar extension of shift operator techniques for SU(3) in an O(3) basis. III. Shift operators of second degree in the tensor components .... See Entry 65071

Indecomposable representations for para-Bose algebra .... See Entry 65072

Intrinsic Lie group and nuclear collective rotation about intrinsic axes .... See Entry 65220

Shift operator techniques for the classification of multipole-phonon states. XI. Properties of mixed type quadratic product operators in R(7) .... See Entry 67133

Shift operator techniques for the classification of multipole-phonon states. XII. O_1^0 eigenstate and eigenvalue determination in R(7) .... See Entry 67134

02.30 FUNCTION THEORY, ANALYSIS

64651 **ERIKA—a program for the decomposition of line spectra.** M.Rysavy, M.Fiser (Nuclear Phys. Inst., Czechoslovak Acad. Sci., Prague, Czechoslovakia).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.171-83 (April 1983).
Line spectra are described by an analytic function depending on several parameters (height, position and shape parameters). The optimum values of these parameters are determined by the minimization of the function χ^2 using the simplex minimization method. Moreover, a background which may also be a function of several parameters is fitted as well. (4 refs.)

64652 **Comments on 'A more precise statement of Hamilton's principle'.** U.Yurtsever (Dept. of Phys., Middle East Tech. Univ., Ankara, Turkey).
Found. Phys. (USA), vol.13, no.5, p.529-37 (May 1983).
Among the problems C.D. Bailey has questioned (ibid., vol.11, p.279, 1981) are a precise and general formulation of Hamilton's variational principle and the establishment of a sufficiency criterion for this to be a minimum principle. The author tries to answer these questions using the geometric theory of classical mechanics. (4 refs.)

64653 **Hamilton's law or Hamilton's principle: a response to Ulvi Yurtsever.** C.D.Bailey (Ohio State Univ., Columbus, OH, USA).
Found. Phys. (USA), vol.13, no.5, p.539-44 (May 1983).
For Yurtsever's paper see ibid., vol.13, no.5, p.529-37 (1983). The law of varying action and Hamilton's principle of classical mechanics are discussed. It is now clear that the law of varying action, introduced by Hamilton in his papers of 1834 and 1835, was never recognised by either the mathematicians or other scientists who followed him. Why this occurred is discussed. (28 refs.)

64654 **A Galerkin method and nonlinear oscillations and waves.** Fengsu Chen, D.Y.Hsieh (Div. of Appl. Math., Brown Univ., Providence, RI, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1041-6 (May 1983).
A Galerkin method is developed as a generalization of the variational averaging method to deal with problems with dissipation. Some nonlinear oscillations, nonlinear waves, and nonlinear stability problems are studied to illustrate the application of the new method. It is demonstrated that when the dissipative parameter is small, the solutions agree with those obtained by other established methods. (8 refs.)

64655 **Some infinite series of products of Legendre and gamma functions.** H.van Haeringen (Dept. of Math., Delft Univ. of Technol., Delft, Netherlands).
J. Math. Phys. (USA), vol.24, no.5, p.1054-7 (May 1983).
The author derives closed expressions for some infinite series of products of Legendre functions and gamma functions. A particular series has been used to obtain the partial-wave projected quantum mechanical Coulomb transition matrix in closed analytic form for all partial waves, $l=0, 1, \ldots$ (9 refs.)

64656 **A simple proof of a transformation formula for elliptic integrals.** B.Bassetti, E.Montaldi, M.Raciti (Istituto di Sci. Fisiche, Univ. degli Studi di Milano, Milano, Italy).
J. Math. Phys. (USA), vol.24, no.5, p.1058-9 (May 1983).
A very simple proof of a quadratic transformation formula for elliptic integrals found by Carlson in 1977 is given. (7 refs.)

64657 **The study of Bloch equations.** E.F.Apushkinskii, E.G.Moskalev.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.105-7 (Feb. 1983). In Russian.
The presentation of the solution of the Bloch matrix equation in the form of the infinite product is considered. A region of this product convergence is found and the convergence is shown to proceed rather quickly. (3 refs.)

Fast relaxation method for solving the difference problem for the Poisson equation on a sequence of grids .... See Entry 64658

Dynamic behavior from asymptotic expansions .... See Entry 64673

On integral equation methods for elastic boundary value problems. I. Direct methods for static problems .... See Entry 64681

Investigations of a two-dimensional integral equation in the theory of elasticity and electrostatics .... See Entry 64683

Exact solutions for a certain hyperbolic 2-conservation law .... See Entry 64684

Integral equations of plane elasticity for multiply connected domains with corners .... See Entry 64685

A boundary integral equation for the solution of a class of problems in anisotropic inhomogeneous thermostatics and elastostatics .... See Entry 64687

Compact finite difference schemes for the Euler and Navier-Stokes equations .... See Entry 64691

On the integrability of the Hirota-Satsuma system .... See Entry 64697

Soliton solutions of the Korteweg-de Vries and Kadomtsev-Petviashvili equations: the wronskian technique .... See Entry 64698

A method of obtaining the *N*-soliton solution of the Boussinesq equation in terms of a wronskian .... See Entry 64699

A hierarchy of coupled Korteweg-de Vries equations .... See Entry 64700

Solution of boundary-value problems by the *G*-polynomial method .... See Entry 64704

Laplace transform method for scattering on Coulomb plus nonlocal separable potentials .... See Entry 64723

The escape time in nonpotential systems .... See Entry 64829

On the dynamics of excitations in disordered systems .... See Entry 64830

Equations of the linear theory of shells with slowly varying curvatures .... See Entry 66460

The variational principles of mechanics for variable domains and their utilization for structural optimization .... See Entry 66462

Finite plastic deformation of a circular membrane under hydrostatic pressure. I. Rate-independent behaviour .... See Entry 66480

A linear integrodifferential equation for viscoelastic rods and plates .... See Entry 66491

Sensitivity of solutions of linear equation for a vibrating membrane to variation of equation coefficients .... See Entry 66502

Three-dimensional curved crack in an elastic body .... See Entry 66515

Mathematical models of the methods for calculations of shape and tensile forces in moving thread systems .... See Entry 66545

***N*-solitons on a vortex filament** .... See Entry 66584

MHD free-convection flow in the Stokes problem for a porous vertical plate by finite difference method .... See Entry 66634

A variational principle for surface waves in magnetohydrodynamics .... See Entry 66645

Modification of the Stokes method of extracting physical broadening of diffraction lines .... See Entry 66781

A program to analyze series of Mossbauer spectra .... See Entry 68087

Automated identification of rock boundaries: an application of the Walsh transform to geophysical well-log analysis .... See Entry 69363

02.40 GEOMETRY, DIFFERENTIAL GEOMETRY, AND TOPOLOGY

(see also 04. Relativity and gravitation)

Comments on 'A more precise statement of Hamilton's principle' .... See Entry 64652

Classical and quantum models of strong cosmic censorship ..... See Entry 64774

Space-time in ordered electromagnetic radiation outside a massive plane .... See Entry 64775

Third-order tensor potentials for the Riemann and Weyl tensors .... See Entry 64778

Hodge theory used to produce finite self-energy models of the electron .... See Entry 64802

Geometrical interpretation of a generalized theory of gravitation .... See Entry 64811

Dyon black hole and its mass formula in the Tomimatsu-Sato-Yamazaki space-time .... See Entry 69490

02.50 PROBABILITY THEORY, STOCHASTIC PROCESSES, AND STATISTICS

(see also 05. Statistical physics)

A probabilistic formulation of quantum theory. III .... See Entry 64730

Quantisation of dynamical systems and stochastic control theory .... See Entry 64751

Equilibrium potential of killed Markov process .... See Entry 64833

Random walk in a random environment and $1/f$ noise .... See Entry 64835

The approach to the Boltzmann distribution in Brownian motion .... See Entry 64837

On random walks in percolation models .... See Entry 64843

Efficient implementation of the Monte Carlo method for lattice gauge theory calculations on the floating point systems FPS-164 .... See Entry 65012

Numerical simulations of quantum chromodynamics .... See Entry 65113

Monte Carlo simulation of radiative corrections to the processes $e^+e^-\to\mu^+\mu^-$ and $e^+e^-\to\bar{q}q$ in the Z_0 region .... See Entry 65139

Stochastic analysis of groundwater flow and contaminant transport in a fractured rock system .... See Entry 65406

Counting a small number of radioactive atoms Monte Carlo program .... See Entry 65770

Brownian dynamics simulation of systems with transitions, particularly conformational transitions in chain molecules .... See Entry 66169

Wave-field statistics in scattering by a system of particles ..... See Entry 66221

Theory of the spectrum of the quantised light field .... See Entry 66248

Comparison of different boundary conditions for Monte Carlo simulations of Ising models .... See Entry 67944

Energy factors of build-up of X-irradiation .... See Entry 68711

Extreme value analysis in meteorology .... See Entry 69300

Analysis of palaeomagnetic time series—techniques and applications .... See Entry 69369

02.60 NUMERICAL APPROXIMATION AND ANALYSIS

64658 **Fast relaxation method for solving the difference problem for the Poisson equation on a sequence of grids.** E.A.Ayrjan, E.P.Zhidkov, B.N.Khoromsky (Lab. of Computing Techniques & Automation, Dubna, Moscow, USSR).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.125-30 (April 1983).
A method for accelerating the convergence of iterative processes on a sequence of grids is proposed, which makes use of the decomposition of the difference solution into powers of the discretization step. Approximation solutions from a number of auxiliary grids are extrapolated to the exact solution on the finest grid. In the case of a difference problem for the Poisson equation the error of such extrapolation on the last grid is quickly suppressed by simple iterations due to some smoothness properties of the difference-operator eigenfunctions. The results of numerical experiments are presented which illustrate the high efficiency of the proposed method for solution of the given problem. (10 refs.)

64659 **Tracing complex singularities with spectral methods.** C.Sulem (Dept. de Math., Univ. de Nice, Nice, France), P.-L.Sulem, H.Frisch.
J. Comput. Phys. (USA), vol.50, no.1, p.138-61 (April 1983).
A numerical method for investigating the possibility of blow-up after a finite time is introduced for a large class of nonlinear evolution problems. With initial data analytic in the space variable(s), the solutions have for any $t>O$ complex-space singularities at the edge of an analyticity strip of width $\delta(t)$. Loss of regularity corresponds to the vanishing of $\delta(t)$. Numerical integration by high resolution spectral methods reveals the large wavenumber behavior of the Fourier transform of the solutions, from which $\delta(t)$ is readily obtained. Its time evolution can be traced down to about one mesh length. By extrapolation of $\delta(t)$, such numerical experiments provide evidence suggesting finite-time blow-up or all-time regularity. The method is tested on the inviscid and viscous Burgers equations and is applied to the one-dimensional nonlinear Schrodinger equation with quartic potential and to the two-dimensional incompressible Euler equation, all with periodic boundary conditions. In the

latter case evidence is found suggesting that existing all-time regularity results can be substantially sharpened. (33 refs.)

64660 Numerical conformal mapping and analytic continuation. F.Bisshopp (Brown Univ., Providence, RI, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.125-42 (April 1983).
A numerical method for determination of least-square approximations of an arbitrary complex mapping function is derived and implemented with fast Fourier transforms (FFTs). An essential feature of the method is the factoring of a discrete Hilbert transform in a pair of Fourier transforms in order to reduce the operation count of the longest computation to $O(\mathrm{N}\log\mathrm{N})$. A similar factoring of the discrete Poisson integral formula allows an explicit inversion of it in $O(\mathrm{N}\log\mathrm{N})$ operations instead of $O(\mathrm{N}^3)$. The resulting scheme for analytic continuation appears to be considerably more reliable than the elevation of polynomials. Examples are treated, and APL implementations of algorithms are provided. (7 refs.)

Progress in boundary element methods. Vol.2 ....See Entry 64606
ERIKA—a program for the decomposition of line spectra ......See Entry 64651
Some difficulties generated by small sinks in the numerical study of dynamical systems: two examples ....See Entry 64670
A boundary integral equation for the solution of a class of problems in anisotropic inhomogeneous thermostatics and elastostatics ....See Entry 64687
Compact finite difference schemes for the Euler and Navier-Stokes equations ....See Entry 64691
Finite element interpolation error bounds with applications to eigenvalue problems ....See Entry 64761
Boundary element solutions to steady convective diffusion equations ....See Entry 64858
A simple method for calculating diffusional recombination probabilities ....See Entry 64861
Exact interpolation of Fourier transform spectra ....See Entry 64954
A finite element method for neutron transport. VII. Completely boundary-free maximum principle for the first-order Boltzmann equation ......See Entry 65304
One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. II. Numerical analysis ....See Entry 65340
Field computation using finite element method ....See Entry 66179
On the solution of integral equations arising in electron optical field computations ....See Entry 66199
On static and dynamic finite element analysis of helical springs and experimental verifications ....See Entry 66451
An analysis of rod-shield constructions by the finite element method ....See Entry 66461
Boundary element method in elastostatics: theory and applications ....See Entry 66463
Finite plastic deformation of a circular membrane under hydrostatic pressure. I. Rate-independent behaviour ....See Entry 66480
Finite plastic deformation of a circular membrane under hydrostatic pressure. II. Strain-rate effects ....See Entry 66481
Three-dimensional curved crack in an elastic body ....See Entry 66515
Numerical optimization studies of axisymmetric unsteady sprays ....See Entry 66617
The application of a modified form of the S_N method to the calculation of swarm parameters of electrons in a weakly ionised equilibrium medium ....See Entry 66660
A nomogram for evaluating the accuracy of determination of the center of gravity of the diffraction line ....See Entry 66782
On the use of penetration depth in thermal transient finite element analysis ....See Entry 67297
Modelling and simulation of a field of heliostats reflecting direct solar radiation onto a fixed target ....See Entry 68855

02.70 COMPUTATIONAL TECHNIQUES

(for data handling and computation, see 06.50)

64661 A geometric approach for mapping of derivatives. E.Keren, O.Kafri (Nuclear Res. Centre-Negev, Beer Sheva, Israel).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.109-12 (April 1983).
A new method for plotting contour maps of equal directional derivatives is proposed. The simple algorithm does not require numerical manipulation of the data as it is based on an optical phenomenon, the moire effect. (4 refs.)

Computer programs for entrance examinations (by COBOL language) ....See Entry 64638
Width-enhanced binary representation for library searching of vapor phase infrared spectra ....See Entry 64965
An analysis of rod-shield constructions by the finite element method ....See Entry 66461

03.00 CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS

03.20 CLASSICAL MECHANICS OF DISCRETE SYSTEMS: GENERAL MATHEMATICAL ASPECTS

(for applied classical mechanics of discrete systems, see 46.10; for celestial mechanics, see 95.10)

64662 Note on equivalent Lagrangians and symmetries. W.Sarlet (Inst. voor Theoretische Mech., Rijksuniv. Gent, Gent, Belgium).
J. Phys. A (GB), vol.16, no.7, p.L229-33 (11 May 1983).
Shows that every ordered pair of equivalent Lagrangians determines an equivalence class of dynamical symmetries of non-Noether type. Its explicit construction merely requires a particular solution of a single partial differential equations. Various related aspects are discussed. (15 refs.)

64663 Symmetries, first integrals, and the inverse problem of Lagrangian mechanics. II. W.Sarlet, F.Cantrijn (Inst. voor Theoretische Mech., Rijksuniv. Gent, Gent, Belgium).
J. Phys. A (GB), vol.16, no.7, p.1383-96 (11 May 1983).
For pt.I see ibid., vol.14, p.2227-38 (1981). The paper investigates under what conditions the knowledge of a symmetry and a first integral of a linear system of second-order differential equations provides information about the existence of a Lagrangian. The relationship between symmetries and first integrals through Noether's theorem thereby plays an essential role. The treatment being confined to linear systems and linear symmetries, it is shown that there is no loss of generality in taking only quadratic Lagrangians into consideration. (27 refs.)

64664 On the amplitude decay of strongly non-linear damped oscillators. T.D.Burton (Dept. of Mech. Engng., Washington State Univ., Pullman, WA, USA).
J. Sound & Vib. (GB), vol.87, no.4, p.535-41 (22 April 1983).
The problem considered is that of the amplitude behavior of the strongly non-linear damped oscillator $\ddot{u}+2\epsilon\dot{u}+u+\alpha f(u)=0$, where ϵ is small, u and $f(u)$ are $O(1)$, α may be arbitrarily large, and $f(u)$ is an odd function. A simple approximation to the amplitude decay is obtained by first linearizing the static terms and then using the WKB approximation. Of particular interest is the influence of the non-linearity on the amplitude decay. Several examples which illustrate this influence are provided. (15 refs.)

64665 Analysis of non-linear autonomous conservative oscillators by a time transformation method. T.D.Burton, M.N.Hamdan (Dept. of Mech. Engng., Washington State Univ., Pullman, WA, USA).
J. Sound & Vib. (GB), vol.87, no.4, p.543-54 (22 April 1983).
The problem considered is that of the free vibration of the class of strongly non-linear oscillators $\ddot{u}+mu+\alpha f(u)=0$, where $m=1,0$, or -1, $f(u)$ is a non-linear function of the displacement $u(t)$, and α is not small. Through a continuous stretching of the time t, a new time T is found in whose domain the response is simple harmonic. This time transformation method allows the response $u(t)$ and period τ to be calculated to any desired degree of accuracy; however, the primary objective is to develop reasonably simple, accurate approximations for the oscillators considered. (18 refs.)

64666 On uniqueness of Gauss' least constraint principle. N.Cyganowa.
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.261-7 (1981). In Polish.
P. Stackel (1919) has investigated the uniqueness of the Gauss' principle for a system with restrained and nonrestrained ideal holonomic and linear nonholonomic constraints of the first order. For a regular position of a system the Gauss' principle determines the motion uniquely, while in a singular case non-uniquely. The subsequent development of the problem can be traced in A. Przeborski's papers who has investigated Gauss' principle for the most general case of holonomic and nonholonomic constraints with friction. (3 refs.)

64667 The determination of dynamic factors in a system with two degrees of freedom and Duffing-Hertz nonlinearity. H.Wojciechowski.
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.315-29 (1981). In Polish.
The linearization method of the non-linear conservative system with two degrees of freedom has been considered. The system is excited by aperiodic or impact loads. Linearization of the non-linear motion equations has been performed after having introduced the main coordinates. The system excited by a triangular pulse has been tested in particular. Also a two-mass system with a joining spring of Hertz characteristics has been considered. The system has been excited by the motion impact of a mass m_1 with the initial velocity v_0. For both systems the dynamic factors have been introduced. (16 refs.)

64668 Non-standard analysis in Newtonian mechanics of mass-point. Systems. I. C.Wozniak (Inst. Mech., Uniwersytet Warszawski, Warsaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.355-74 (1981). In Polish.
The author's aim is to apply and to investigate non-standard analysis as the mathematical tool of Newtonian mechanics. Such an approach introduces into mechanics non-Archimedean ordered fields and makes it possible to describe explicitly infinite and infinitesimal values of the physical quantities. Generally speaking, the methods of non-standard analysis in Newtonian mechanics of mass-point systems lead to the wider class of mathematical models of physical phenomena than that which can be obtained within the classical formulation of the discrete mechanics. For example, from the non-standard formulation of the Newton's law of motion in discrete mechanics one can derive the fundamental 'standard' relations of continuum mechanics. The general introduction into non-standard analysis as well as the fundamentals of Newtonian mechanics within non-standard analysis have been outlined. As an example of applications, the new interpretation of the standard concept of constraints has been derived from the Newton's law of motion of certain non-standard unconstrained mass-point systems. (13 refs.)

64669 Fast motion of a heavy rigid body about a fixed point in a resistive medium. L.D.Akulenko, D.D.Leshchenko, F.L.Chernous'ko.
Mech. Solids (USA), vol.17, no.3, p.1-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.5-13 (1982).
Investigates fast rotational motion of a heavy rigid body about a fixed point when external resistance is present. The moment of the resistive forces is assumed to be a linear function of the angular velocity. The system obtained after averaging with respect to Euler-Poinsot motion is analyzed, in the case of fast rotations. (12 refs.)

64670 Some difficulties generated by small sinks in the numerical study of dynamical systems: two examples. J.M.Gambaudo (Dept. de Math., Nice, France), C.Tresser.
Phys. Lett. A (Netherlands), vol.94A, no.9, p.412-14 (4 April 1983).
The authors give explicit examples of periodic sinks with very tiny domains of regular attraction, and of misleading numerical computations of Lyapunov exponents. (3 refs.)

64671 Gyrational motion of disks during free-fall. R.E.Stewart, R.List (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Phys. Fluids (USA), vol.26, no.4, p.920-7 (April 1983).
Experiments with disks having diameters from 2.0 to 3.1 cm falling freely in air at speeds of 1.7-3.3 m $\sec^{-1}$ were conducted with a vertically driven, also falling, high-speed camera in order to show that the gyroscopic-like motion, gyration, is the most general type of rotational motion. From analysis of the films, position and orientation were measured throughout the fall and translatory and angular motions were determined, together with the forces and torques which caused the motion. The existence of gyrational motions was confirmed together with straight oscillatory and rotational fall behavior. Typical nutation/precession frequencies were in the range of 6-11 Hz while typical angular frequencies about the minor axis were 1.8-3.0 Hz. The likelihood of gyration increased with particle density. The observed gyration characteristics of disks were similar to predictions for oblate spheroids. Further, it is postulated that air influences can cause rotation about a horizontal diameter to become unstable and to consequently evolve into gyration. This gyrational

motion may represent a very general mode of free fall for other shapes in a similar range of Reynolds numbers from 2000-5000. (17 refs.)

64672 Modification of Dirac's method of Hamiltonian analysis for constrained systems. R.Di Stefano (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1752-65 (15 April 1983).
A slight modification of Dirac's method of Hamiltonian analysis for constrained systems is introduced. It leads to a verification of Dirac's conjecture that first-class secondary constraints are always symmetry generators in each of the counterexamples to that conjecture which have appeared in the recent literature. Those counterexamples associated with differentiable Hamiltonians are studied; the cases involving nondifferentiable Hamiltonians will be considered separately. The relationship between the Lagrangian and Hamiltonian descriptions is studied in some detail and is used to motivate the author's calling the form of the secondary constraints derived via this modified method the natural form of the secondary constraints. Along the way the author distinguishes between symmetries of the Lagrangian (or Hamiltonian) and symmetries of the Euler-Lagrange (or Hamilton's) equations; the author also distinguishes between form and content invariance. (16 refs.)

64673 Dynamic behavior from asymptotic expansions. J.K.Hale (Brown Univ., Providence, RI, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.161-8 (April 1983).
The authors discuss stability properties of solutions of periodic and almost-periodic differential equations containing a small parameter. The existence of the solution can be obtained in the first approximation but the stability only after k approximations. The results are obtained using asymptotic expansions, higher-order averaging and the concept of exponential hyperbolicity of order k. (7 refs.)

64674 Iteration dynamics. E.Pina (Dept. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.173-96 (Feb. 1983).
A discontinuous formulation of mechanics is developed starting from elementary examples. Linear systems are incorporated and an exact treatment of the pendulum is represented in terms of rational and trigonometric functions. The general formulation for a hamiltonian system is included. A short account of some fundamental properties of iterations, including conjugation and its relation to functional equations, is made. Finally, some properties of the logistic map are studied by using Newton's method to obtain the roots of an equation and a sketch of the method of periodic points is presented. (22 refs.)

A constant force generator for the demonstration of Newton's second law .... See Entry 64617

Dynamics of nonlinear dissipative oscillators .... See Entry 64618

Comments on 'A more precise statement of Hamilton's principle' .... See Entry 64652

Hamilton's law or Hamilton's principle: a response to Ulvi Yurtsever .... See Entry 64653

Comment on 'hopping mechanism generating $1/f$ noise in nonlinear systems' .... See Entry 64836

Equivalent Lagrangians in field theory .... See Entry 65022

A classical model of the photon echo .... See Entry 66354

Attitude stability of torque-free axisymmetric dual spinners with energy sinks, considering spin change allotment between rotor and platform .... See Entry 66452

Problem of three rigid bodies. Conversion of the Hamiltonian to Delaunay and Andoyer variables .... See Entry 69478

03.30 SPECIAL RELATIVITY

64675 Relativistic kinematical diagrams. B.D.Dimitriadis (Phys. Dept., Univ. of Thessaloniki, Thessaloniki, Greece).
Eur. J. Phys. (GB), vol.3, no.4, p.193-201 (1982).
A new geometrical approach to the special relativistic kinematics is described. This approach is based on a relative motion of x axes of inertial frames. The transformation equations valid for this motion are those of Lorentz for the x axes. Since the actual relative motion is involved in the method proposed, it is especially helpful in grasping the deeper physical concept of Special Relativity. (7 refs.)

64676 Manifestly covariant, coordinate-free dyadic expression for planar homogeneous Lorentz transformations. D.E.Fahnline (Pennsylvania State Univ., Altoona, PA, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1080-6 (May 1983).
Parametrizing a planar homogeneous Lorentz transformation P by any timelike or spacelike vector b lying in the transformation plane and its transform $a \equiv Pb$ yields a dyadic expression for P with several advantages. It provides an immediate solution to the problem of finding a homogeneous Lorentz transformation converting a given timelike or spacelike vector into a second similar vector. Its manifestly covariant, coordinate-free form is valid in any Lorentz frame and reduces easily to coordinate form. It unifies timelike (including boosts), spacelike (including pure spatial rotations), and null planar transformations and also orthochronous and nonorthochronous planar transformations into a single form; these classifications depend on the vectors a and b. Only if $a = -b$ does the expression fail, but then its limit as $a \to -b$ still exists and provides a valid expression for P. (8 refs.)

64677 Superluminal coordinate transformations: four-dimensional case. L.Marchildon, A.F.Antippa (Dept. de Phys., Univ du Quebec a Trois-Rivieres, Trois-Rivieres, Quebec, Canada), A.E.Everett.
Phys. Rev. D (USA), vol.27, no.8, p.1740-51 (15 April 1983).
The authors investigate, from a group-theoretical point of view, the possibility of implementing the so-called extended principle of relativity. This consists in postulating that the set of all equivalent reference frames contain frames whose relative velocities are larger than c, in addition to those whose coordinates are related by proper orthochronous Lorentz transformations. They show that implementing the extended principle of relativity by means of either real or complex linear transformations results in strong conflicts with experiment and/or intractable problems of interpretation. They then briefly analyse alternative approaches to four-dimensional superluminal transformations, in which the extended principle of relativity is either weakened or completely abandoned. (43 refs.)

64678 One-dimensional relativistic motion of two bodies with a constant magnitude of the interaction force. N.S.Shavokhina (Joint Inst. for Nuclear Res., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.641-4 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.66-9 (July 1982). [received: May 1983]
The relativistic linear motion of two bodies with a constant magnitude of the interaction force is considered. Inelastic and elastic collisions of these bodies are investigated. A mathematically exact model of the relativistic oscillator is constructed. (4 refs.)

The computational metaphor and quantum physics .... See Entry 64710

03.40 CLASSICAL MECHANICS OF CONTINUOUS MEDIA: GENERAL MATHEMATICAL ASPECTS

64679 Damage tensors in continuum mechanics. J.Betten (Dept. of Math. Models in Materials Sci., Tech. Univ. Aachen, Aachen, Germany).
J. Mec. Theor. & Appl. (France), vol.2, no.1, p.13-32 (1983).
Starting from a third order skew-symmetric tensor of continuity to represent area vectors (bivectors) of Cauchy's tetrahedron in a damaged stage, the author finally finds a damage tensor of rank two. Constitutive equations of creep are formulated by employing the damage tensor of rank two and a fourth-order tensor characterizing the initial anisotropy or the anisotropy of the material in its undamaged state. In finding very general constitutive equations an irreducible set of tensor generators involving the mentioned argument tensors and an integrity basis associated with the representation of the tensor response function are constructed. In view of more practical use, some simplified representations are discussed. (30 refs.)

64680 An alternative proof of the representation theorem for isotropic, linear asymmetric stress-strain relations. G.Zhong-Heng (Johns Hopkins Univ., Baltimore, MD, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.119-23 (April 1983). (5 refs.)

Comments on 'A more precise statement of Hamilton's principle' .... See Entry 64652

Hamilton's law or Hamilton's principle: a response to Ulvi Yurtsever .... See Entry 64653

Non-standard analysis in Newtonian mechanics of mass-point. Systems. I .... See Entry 64668

The variational principles of mechanics for variable domains and their utilization for structural optimization .... See Entry 66462

On the relationship between the logarithmic strain rate and the stretching tensor .... See Entry 66486

A linear integrodifferential equation for viscoelastic rods and plates .... See Entry 66491

03.40D Mathematical theory of elasticity

(see also 46.20 Continuum mechanics, and 46.30 Mechanics of solids)

64681 On integral equation methods for elastic boundary value problems. I. Direct methods for static problems. K.Takakuda (Tokyo Inst. of Technol., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.212, p.186-93 (Feb. 1983).
The applications of the boundary integral equation methods (direct methods) to static elasticity problems are investigated. It is shown that considerable errors may occur in numerical solutions if integral equations are used uncritically. Several suggestions and modifications for the integral equations are presented. (11 refs.)

64682 On the Saint-Venant principle in elasticity. P.Ladeveze (Lab de Mecanique et Technol., ENSET, Cachan, France).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.161-84 (1983). In French.
An interpretation of the Saint-Venant Principle is proposed. It is developed in the case of elastic anisotropic homogeneous beams of constant cross-section. Two Saint-Venant principles are given, one for the localization of the stresses and the second for the localization of the displacements. Furthermore, some results are given on the structure of solutions to the Saint-Venant problem. (24 refs.)

64683 Investigations of a two-dimensional integral equation in the theory of elasticity and electrostatics. T.S.Sankar, V.I.Fabrikant (Dept. of Mech. Engng., Concordia Univ., Montreal, Quebec, Canada).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.285-99 (1983).
A two-dimensional integral equation, encountered in some problems of nonhomogeneous elasticity and electrostatics, is considered. An exact solution of this equation is obtained by a special integral representation of the kernel. Two theorems of general mathematical interest are established. Illustrative examples are also considered. (10 refs.)

64684 Exact solutions for a certain hyperbolic 2-conservation law. P.H.Chang (Univ. of Nebraska, Omaha, NE, USA).
Houston J. Math. (USA), vol.8, no.4, p.463-76 (1982).
Considers a certain nonlinear hyperbolic system of two equations in two unknowns with initial conditions prescribed along a segment $-b \leq X \leq b, b > 0$. By a holograph transformation one can invert such a nonlinear hyperbolic system to a linear Euler-Poisson-Darboux (EPD) equation, which describes the vibrations of a membrane and whose solutions can be constructed explicitly in some cases. For these cases, the author uses the inverse functions of the solutions to construct the solutions of the previous nonlinear hyperbolic system. (9 refs.)

64685 Integral equations of plane elasticity for multiply connected domains with corners. S.S.Zargaryan.
Mech. Solids (USA), vol.17, no.3, p.77-86 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.87-98 (1982).
The Sherman-Lauricella integral equations, which yield solutions for plane problems of elasticity for multiply connected regions with a smooth boundary in the case of external forces specified on the boundary, are extended to the case of regions with piecewise-smooth contours. The integrals in this equation are considered as Stieltjes integrals with continuous density; it is demonstrated that the integral operator of the equation when there are corner points on the contour is a generalized Fredholm operator. (20 refs.)

64686 Stress-concentrations in a thin insulated metallic disc in the form of an inverse of an ellipse lying horizontally in a uniform electric field. M.Majumder.
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.606-12 (Nov. 1982). [received: April 1983]
The author deals with a plane-strain problem concerning an isotropic, elastic disc in the form of an inverse of an ellipse, subjected to a uniform electric field. In the problem, stresses and displacements have been expressed in terms of two analytic functions $\Omega(z)$ and $\omega(z)$. The conditions that the boundary is stress-free has been expressed in the form of a functional equation. Using function theoretic method and splitting up $\Omega(\sigma)$ into even and odd functions of σ, the functional equation has been solved and the solution has been obtained in a closed form. (3 refs.)

64687 A boundary integral equation for the solution of a class of problems in anisotropic inhomogeneous thermostatics and elastostatics. D.L.Clements (Univ. of Adelaide, Adelaide, Australia), C.Rogers.
Q. Appl. Math. (USA), vol.41, no.1, p.99-105 (April 1983).
The solution of an important class of boundary-value problems in anisotropic inhomogeneous thermostatics and elastostatics is obtained in terms of a boundary integral equation. The equation may be used as a basis for the numerical solution of particular boundary-value problems. (5 refs.)

64688 Elastic strings under vertical loads. H.J.Weinitschke (Inst fur Angewandte Math., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.218-30 (March 1983).
The general nonlinear equations of an elastic string of length 2 L subject to a symmetric vertical dead load $p(s)=p(-s)$ are analyzed. Existence of unique tensile and not necessarily unique compressive solutions with fixed horizontal displacements $u(\pm L)=\pm u_0$ is proved for a general class of stress strain laws $T=f(e)$. The kinetic stability of tensile solutions ($e>0$) is verified exactly. Kinetic instability of compressive solutions ($e<0$) is obtained only approximately, because a rigorous analysis leads to an unusual indefinite eigenvalue problem that has not been solved yet. (7 refs.)

Progress in boundary element methods. Vol.2 ....See Entry 64606

Gibbs' principle and thermodynamic inequalities for nonlinear-elastic bodies .....
........................See Entry 64868

03.40G Fluid dynamics: general mathematical aspects

(see also 47. Fluid dynamics)

64689 Stationary probability distribution for nonlinear dynamical systems with noise. M.Machacek (Astron. Inst., Czechoslovak Acad. Sci., Ondrejov, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.365-76 (1983).
Any realistic dissipative dynamical system is subject to thermal noise. When this fact is taken into account, the deterministic system of equations is replaced by a system of stochastic differential equations, whose solution is a diffusion process. Transition probability, and hence the stationary probability density, of these processes can be calculated by means of theorems by Girsanov and by Liptser and Shiryaev (1974). The stationary probability density is the solution of an integral equation, the kernel of which is given. (7 refs.)

64690 Homogeneous property and flux splitting in gas dynamics. A.Lerat (Ecole Nationale Superieure d'Arts et Metiers, Paris, France).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.185-213 (1983). In French.
Considers the homogeneous property of fluxes in gas dynamics and its consequences for flux splitting introduced by Steger and Warming (1981). For any hyperbolic system $w_t+f(w)_x=0$ satisfying the homogeneous property, it is shown that the flux $f(w)$ can be expressed remarkably in terms of the eigenvalues and eigenvectors of the matrix $A(w)=df(w)/dw$ and that the same result holds for the split fluxes $f^+(w)$ and $f^-(w)$. These results are used to study the problem of the validity of flux splitting. Then, three applications of flux splitting are considered: the first one concerns uncentered schemes and specially a precise analysis of their stability, the second one is connected with a method for correcting the dispersive error of second-order accurate schemes and the third application deals with a nonreflecting boundary condition. (13 refs.)

64691 Compact finite difference schemes for the Euler and Navier-Stokes equations. M.E.Rose (Inst. for Computer Applications in Sci. & Engng., NASA Langley Res. Center, Hampton, VA, USA).
J. Comput. Phys. (USA), vol.49, no.3, p.420-42 (March 1983).
Implicit compact finite difference schemes for the Euler equations are described, which furnish equivalent treatment of the conservation and nonconservation forms; a simple modification yields an entropy-producing scheme. An extension of the scheme also treats the compressible Navier-Stokes equations; when the viscosity and heat conduction coefficients are negligible only the boundary data appropriate to the Euler equation influence the solution to any significant extent, a result consistent with singular perturbation theory. (6 refs.)

Progress in computational physics ....See Entry 66547

Steady viscous flows by compact differences in boundary-fitted coordinates ......
........................See Entry 66551

Adiabatic shearing of incompressible fluids with temperature-dependent viscosity ....See Entry 66603

The dynamics of simple fluids in steady circular shear ....See Entry 66604

A variational principle for surface waves in magnetohydrodynamics ....
........................See Entry 66645

03.40K Waves and wave propagation: general mathematical aspects

(see also 46.30M Mechanical and elastic waves, 43.20 General linear acoustics)

64692 A new method for generating precisely triangular waves, square waves and trapezoidal waves in three phases. B.Z.Kaplan (Dept. of Electrical Engng., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.2, p.177-83 (April 1983).
A new compact oscillator model for generating symmetrically three phases of triangular, square and trapezoidal waves is developed. Its generated waveforms are precisely stabilized in steady state and they possess a uniquely determined size. The development of the model is carried out with the aid of a previously treated three-dimensional sinusoidal oscillator model of similar performance whose structure is imitated. The dynamic behaviour of the new model is assessed by a numerical solution of its equations on a digital computer. The main advantage of the present model, when compared to a somewhat related three-phase generator model of triangular waves suggested by the authors previously, is that its generated waveforms are all centered around a zero bias level. This feature contributes towards a possibility of a versatile use of the model for the relatively precise applications envisaged in the conclusions section. (6 refs.)

64693 The scattering of a scalar wave by a thin oblate body of revolution. D.Homentcovschi (Central Inst. of Math., Bucharest, Rumania).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.635-48 (1983).
The scattering of a scalar incident wave by a thin oblate body of revolution is studied. The scattering wave is represented as a distribution of ring singularities in a disk inside the body. Boundary conditions result in one-dimensional integral equations for singularity distributions. The asymptotic solution of these equations for thin bodies furnished the singularity distribution as well as the radius α of the disk containing ring singularities. Example of the plane wave axially incident upon an oblate ellipsoid is presented. The total scattering cross-section is computed. (4 refs.)

64694 Wave equation Green's function approximations for nearly-planar half-planes and half-spaces. L.M.Brock (Dept. of Engng. Mech., Univ. of Kentucky, Lexington, KY, USA).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.649-62 (1983).
Studies of subsurface wave-scattering often rely on wave equation Green's functions for half-planes or half-spaces with plane surfaces. Small deviations from the planar are assumed to have negligible effect away from the surface. Based on extensively-developed perturbation schemes, the author gives analytical first-order approximations for 2D and 3D wave equation Green's function in the interiors of respectively, half-spaces by two approaches. The first approach involves a boundary perturbation, while the second approach invokes a coordinate transformation leading to a perturbation of the governing equations themselves. The case of, respectively, the functions and their normal derivatives vanishing on the surface are treated. Some numerical results for specific examples are presented and discussed. (15 refs.)

64695 An iterative method for the Helmholtz equation. A.Bayliss (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA), C.I.Goldstein, E.Turkel.
J. Comput. Phys. (USA), vol.49, no.3, p.443-57 (March 1983).
An iterative algorithm for the solution of the Helmholtz equation is developed. The algorithm is based on a preconditioned conjugate gradient iteration for the normal equations. The preconditioning is based on an SSOR sweep for the discrete Laplacian. Numerical results are presented for a wide variety of problems of physical interest and demonstrate the effectiveness of the algorithm. (27 refs.)

64696 Restricted multiple three-wave interactions: integrable cases of this system and other related systems. C.R.Menyuk, H.H.Chen, Y.C.Lee (Lab. for Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1073-9 (May 1983).
Restricted multiple three-wave interactions, in which a set of wave triads interact through one shared wave, are discussed. It is shown that this system is integrable when all triads have equal coupling coefficients regardless of the frequency mismatches. This system is then used as a starting point from which to determine integrable cases of a more general class of three-wave interactions. (11 refs.)

64697 On the integrability of the Hirota-Satsuma system. W.Oevel (Univ. Paderborn, Paderborn, Germany).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.404-7 (4 April 1983).
The author considers a system of coupled KdV equations which was conjectured to be integrable by Hirota and Satsuma (1981). Using the Lax-pair of this system he finds an infinite hierarchy of commuting symmetries and conservation laws in involution. Yet, the system does not seem to be 'completely integrable' in the usual sense. (10 refs.)

64698 Soliton solutions of the Korteweg-de Vries and Kadomtsev-Petviashvili equations: the wronskian technique. N.C.Freeman, J.J.C.Nimmo (Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.1-3 (11 April 1983).
The soliton solutions of the KdV and KP equations are written in wronskian form and shown by direct substitution to satisfy the equations and the associated Backlund transformation. (6 refs.)

64699 A method of obtaining the *N*-soliton solution of the Boussinesq equation in terms of a wronskian. J.J.C.Nimmo, N.C.Freeman (Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.4-6 (11 April 1983).
By means of a Backlund transformation for the Boussinesq equation in bilinear form, the wronskian form of the N-soliton solution of that equation is deduced. The solution is then verified by direct substitution in the equation. (9 refs.)

64700 A hierarchy of coupled Korteweg-de Vries equations. D.Levi (Istituto di Fisica, Univ. di Roma I, Rome, Italy).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.7-10 (11 April 1983).
The author presents a hierarchy of coupled nonlinear partial differential equations which contains among its members the Hirota and Satsuma coupled Korteweg-de Vries equations; he also displays its simplest Backlund transformation. (8 refs.)

64701 Nonlinear electron Landau damping of ion-acoustic solitons. J.D.Meiss (Inst. for Fusion Studies, Univ. of Texas, Austin, TX, USA), P.J.Morrison.
Phys. Fluids (USA), vol.26, no.4, p.983-9 (April 1983).
Several authors have treated kinetic effects associated with the ion-acoustic soliton; e.g. Ott and Sudan (1969) investigated linear electron Landau damping and Karpman (1979) and Lotko (1982) have looked at damping due to ion reflection. Here an O'Neil-type frozen wave calculation that includes effects associated with electron orbits in a soliton is presented. This calculation differs from previous ones in that the usual three time scale argument is made: $\omega_{pe}\gg\omega_{be}\gg\gamma_L$. The orbit effects included in this ordering become important at the modest amplitude $e\Phi/T_e\gtrsim(m_e/m_i)^2$. Saturation at finite amplitude is predicted. (21 refs.)

64702 An exterior interface problem in two-dimensional elastodynamics. J.Bielak, R.C.MacCamy (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.143-59 (April 1983).
The authors present and analyze a method of solution for an interface problem in linear elasticity. The special situation of steady-state time-harmonic, two-dimensional anti-plane strain is dealt with. The physical problem is that one has a half-space of homogeneous, isotropic, linearly elastic material (the Earth) bounded by a traction-free plane. In this material there is an elastic wave incident plus reflected, which is time-periodic with frequency ω. It is assumed that a cylindrical obstacle of different and possibly inhomogeneous material is inserted in the free surface. The problem is to determine the time-period steady-state limit for the total fields inside and outside the obstacle. (11 refs.)

64703 Effects of double passage of waves in randomly inhomogeneous media. Yu.A.Kravtsov, A.I.Saichev (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
Sov. Phys.-Usp. (USA), vol.25, no.7, p.494-508 (July 1982). Translation of: *Usp. Fiz. Nauk (USSR)*, vol.137, no.3, p.501-7 (July 1982). [received: April 1983]
In this review, the effects stemming from double passage of reflected and backscattered waves through the same inhomogeneities of the medium, are discussed. The enhancement of phase and intensity fluctuations and of the average intensity and other effects, characteristic of double passage, are described in detail. Multichannel coherent effects, arising due to mutual coherence of different waves passing in opposite directions along identical

channels, are investigated. The experimental work on double passage effects is reviewed. Possible practical applications of these effects are analyzed. (75 refs.)

64704 Solution of boundary-value problems by the *G*-polynomial method. A.K.Orlov.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1314-17 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2134-9 (Nov. 1982). [received: May 1983]
A method is suggested for solving boundary-value problems in mathematical physics using generalized harmonic polynomials. Equations are derived for calculating the parameters of waveguides and resonators bounded by surfaces with complex geometries. The boundary conditions are used to derive equations for the eigenfrequencies. For a spherical resonator, the method gives results accurate to better than 0.01%. The parameters are calculated for a waveguide with polygonal cross section and a problem involving rod torsion is solved. (7 refs.)

64705 A note on the existence of periodic travelling wave solutions with large periods in generalized reaction-diffusion systems. K.R.Schneider (Inst. fur Math., Akad. der Wissenschaften, Berlin, Germany).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.236-40 (March 1983).
The authors shows that the existence of wave trains with high velocity of generalized reaction-diffusion equations can be easily established by using a theorem of D.V. Anosov on the existence of periodic solutions of singularly perturbed differential systems. (5 refs.)

Progress in boundary element methods. Vol.2 ....See Entry 64606
Dilatons as one type of soliton ....See Entry 64857
Extreme picosecond pulse narrowing by means of soliton effect in single-mode optical fibres ....See Entry 66399
Waves in weakly anisotropic media ....See Entry 66505

03.50 CLASSICAL FIELD THEORY

64706 The equations of nonlinear electrodynamics as a conservative symmetric-hyperbolic system in generalized co-ordinates. A.Strumia (Istituto di Matematica Applicata, Univ. di Bologna, Bologna, Italy).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.569-73 (23 April 1983).
It is shown that by employing generalized co-ordinates that the system of equations governing nonlinear electrodynamics is a system of conservative equations with convex density. The convexity conditions are given in an explicitly covariant fashion. (13 refs.)

Singularities of angular spectral characteristics of the radiation of an electron moving along the arc of a circle ....See Entry 66190

03.65 QUANTUM THEORY; QUANTUM MECHANICS

(see also 05.30 Quantum statistical mechanics; for relativistic wave equations, see 11.10)

64707 The Aharonov-Bohm effect and scattering theory. S.N.M.Ruijsenaars (Max-Planck-Inst. fur Phys. und Astrophys., Munich, Germany).
Ann. Phys. (USA), vol.146, no.1, p.1-34 (March 1983).
The Aharonov-Bohm effect is studied from the viewpoint of scattering theory. A scattering experiment is proposed that could distinguish between two different dynamics that have been considered in the literature. The behavior of the *S*-matrices under gauge transformations is established and an anomalous cluster property is found. (57 refs.)

64708 Some quantum operators with discrete spectrum but classically continuous spectrum. B.Simon (Dept. of Math., California Inst. of Technol., Pasadena, CA, USA).
Ann. Phys. (USA), vol.146, no.1, p.209-20 (March 1983).
The author considers a number of simple quantum Hamiltonians $H(-i\nabla,x)$ with the following property: $H(-i\nabla,x)$ has discrete spectrum even though $\{(p,q)|H(p,q)<E\}$ has infinite volume. (9 refs.)

64709 Energy spectrum of the Kratzer interaction. J.A.C.Gallas (Max-Planck-Inst. fur Quantenoptik, Garching, Munchen, Germany).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.479-80 (15 April 1983).
Kesarwani and Varshni (1982) recently reported the WKB approximation to be capable of producing highly accurate eigenvalues for Kratzer's interaction, if an adequate number of high-order corrections were taken into account. The present author shows that by making the Langer transformation, it is possible to reproduce the known exact results within the first-order theory. (11 refs.)

64710 The computational metaphor and quantum physics. M.J.Manthey, B.M.E.Moret (Univ. of New Mexico, Albuquerque, NM, USA).
Commun. ACM (USA), vol.26, no.2, p.137-45 (Feb. 1983).
Concurrent computational systems, viewed as sets of cooperating processes, are shown to have close analogies in the world of quantum physics. In particular, analogies exist between processes and particles, between a process' state and a particle's mass, between a process's state changes and a particle's velocity, and between interprocess communications and particle interactions. This view allows the application in the computational world of special relativity theory, the uncertainty principle, the law of conservation of momentum, and many of particle physics' fundamental results. This paper describes the basic analogy and some fundamental results. It is the authors' belief that new insights into computational processes will be gained as the analogy is developed and vice versa. It is conceivable that established results of the computational sciences may contribute to a new understanding of some of the problems of physics. Other process-oriented sciences, such as biology, economics, and psychology, could also benefit from such developments. (18 refs.)

64711 On the Schrodinger equation and the eigenvalue problem. P.Li (Dept. of Math., Stanford Univ., Stanford, CA, USA), Shing-tung Yau.
Commun. Math. Phys. (Germany), vol.88, no.3, p.309-18 (March 1983).
If λ_k is tshe k^{th} eigenvalue for the Dirichlet boundary problem on a bounded domain in $\mathbf{R}^n$, H. Weyl's asymptotic formula asserts that $\lambda_k \sim C_n(k/V(D))^{2/n}$, hence $\Sigma_{i=1}{}^k \lambda_i \sim xC_n k^{-x} V(D)^{-2/n}$, were $x=(n+2)/n$. The authors prove that for any domain and for all k, $\Sigma_{i=1}{}^k \lambda_i \geq xk^{-x} V(D)^{-2/n}$. A simple proof for the upper bound of the number of eigenvalues less than or equal to $-\alpha$ for the operator $\Delta\text{-}V(x)$ defined on $\mathbf{R}^n(n \geq 3)$ in terms of $\int_{\mathbf{R}^n}(V+\alpha)_-{}^{n/2}dx$ is also provided. (9 refs.)

64712 Schrodinger operators with an electric field and random for deterministic potentials. F.Bentosela (Dept. de Phys., Univ. de Luminy Marseille, Marseille, France), R.Carmona, P.Duclos, B.Simon, B.Souillard, R.Weder.
Commun. Math. Phys. (Germany), vol.88, no.3, p.387-97 (March 1983).
The authors prove that the Schrodinger operator $H=-d^2/dx^2+V(x)+F.x$ has purely absolutely continuous spectrum for arbitrary constant external field F, for a large class of potentials; this result applies to many periodic, almost periodic and random potentials and in particular to random wells of independent depth for which we prove that when $F=0$, the spectrum is almost surely pure point with exponentially decaying eigenfunctions. (12 refs.)

64713 Examples of discrete Schrodinger operators with pure point spectrum. J.Poschel (ETH-Zentrum, Zurich, Switzerland).
Commun. Math. Phys. (Germany), vol.88, no.4, p.447-63 (1983).
Presents a general approach for constructing potentials for the discrete Schrodinger equation of arbitrary dimension having only pure point spectrum. The author gives examples of limit periodic potentials of that kind such that the pure point spectrum is dense in an interval of a Cantor set of measure zero. (8 refs.)

64714 Localization in ν-dimensional incommensurate structures. J.Bellissard (Univ. de Provence, Marseille, France), R.Lima, E.Scoppola.
Commun. Math. Phys. (Germany), vol.88, no.4, p.465-77 (1983).
The authors exhibit a class of quasi-periodic unbounded potential in the ν-dimensional discrete Schrodinger equation, for which the spectrum is only pure point, with exponentially localized states and a dense set of eigenvalues in $\mathbf{R}$. (11 refs.)

64715 Nonlocality and the Kochen-Specker paradox. P.Heywood, M.L.G.Redhead (Dept. of History & Philosophy of Sci., Chelsea Coll., Univ. of London, London, England).
Found. Phys. (USA), vol.13, no.5, p.481-99 (May 1983).
A new proof of the impossibility of reconciling realism and locality in quantum mechanics is given. Unlike proofs based on Bell's inequality, the authors make minimal and transparent use of probability theory and proceed by demonstrating a Kochen-Specker type of paradox based on the value assignments to the spin components of two spatially separated spin-1 systems in the singlet state of their total spin. An essential part of the argument is to distinguish carefully two commonly confused types of contextuality; the authors call them ontological and environmental contextuality. These in turn are associated with two quite distinct senses of nonlocality. The relevance of the treatment to other related discussions in recent literature on the philosophy of quantum mechanics is indicated. (21 refs.)

64716 On the extended characterisation theorem for quantum logics. E.David (Dept. of Math., Polytech. of the South Bank, London, England), C.S.Sharma.
J. Phys. A (GB), vol.16, no.6, p.L179-80 (21 April 1983).
An inaccuracy in the definition of dual automorphism of a lattice by Sharma and Mukherjee (1977) is corrected and some interesting ramifications are discussed. (3 refs.)

64717 On the Schrodinger equation for the gaussian potential $-A$ exp$(-\lambda r^2)$. C.S.Lai (Dept. of Phys., Univ. of Prince Edward Island, Charlottetown, Prince Edward Island, Canada).
J. Phys. A (GB), vol.16, no.6, p.L181-5 (21 April 1983).
The energy eigenvalues of the attractive radial gaussian potential for various eigenstates are very accurately determined within the framework of the hypervirial-Pade scheme. (12 refs.)

64718 A multiparticle Coulomb system with bound state at threshold. M.Hoffmann-Ostenhof (Inst. fur Theoretische Phys., Univ. Wien, Wien, Austria), T.Hoffmann-Ostenhof, B.Simon.
J. Phys. A (GB), vol.16, no.6, p.1125-31 (21 April 1983).
The authors consider the two-electron Hamiltonian $H=-\Delta_1-\Delta_2-r_1{}^{-1}-r_2{}^{-1}+Ar_{12}{}^{-1}$ at precisely that critical value of A where the ground state energy has just hit the continuum. For that A, it is proven that H has a square integrable eigenfunction at the bottom of the continuum. (17 refs.)

64719 Direct verification of the quantum spin-state superposition law. G.Badurek, H.Rauch, J.Summhammer (Atominst., Osterreichischen Univ., Wien, Austria), U.Kischko, A.Zeilinger.
J. Phys. A (GB), vol.16, no.6, p.1133-9 (21 April 1983).
Coherent superposition of two neutron waves, with mutually opposite polarisation direction, is used to demonstrate the quantum-mechanical properties of spin-state superposition for fermions. (20 refs.)

64720 The Casimir invariants and Gel'fand basis of the graded unitary group SU(m/n). Jin-Quan Chen (Dept. of Phys., Nanjing Univ., Nanjing, China), Xuan-Gen Chen, Mei-Juan Gao.
J. Phys. A (GB), vol.16, no.7, p.1361-76 (11 May 1983).
In the space of f-particle product states, the Casimir invariants of the graded unitary group SU(m/n) are functions of the class operators of the graded coordinate permutation group $\mathring{S}(f)$, which are equal to the class operators of the graded state permutation group $\mathring{\mathcal{S}}(f)$. Formulae for the quadratic and cubic Casimir invariants are given. It is shown that in general the eigenvalue formulae for the U(m/n) Casimir invariants as functions of the partition can be obtained from those for U$(m+n)$ by simply changing the argument of the functions from $(m+n)$ to $(m-n)$. The quasi-standard basis of $\mathring{\mathcal{S}}(f)$ is identified with the Gel'fand basis of SU(m/n), i.e. the irreducible basis classified according to the group chain $\mathrm{SU}(m/n)\supset\mathrm{SU}(m/n-1)\supset\ldots\mathrm{SU}(m)\supset\ldots\mathrm{SU}(2)\supset\mathrm{U}(1)$. The special Gel'fand basis of SU(m/n) (for which the weight is restricted to (1,1,...,1)) can be easily obtained from the Gel'fand basis of SU$(m+n)$ with due allowances for modifying sign factors arising from the grading. The construction of a general SU(m/n) Gel'fand basis is also discussed. (30 refs.)

64721 Boson realisation of the Lie algebra F_4 and non-trivial zeros of 6*j* symbols. J.Van der Jeugt, G.Vanden Berghe, H.De Meyer (Seminarie voor Wiskundige Natuurkunde, Rijksuniv. Gent, Gent, Belgium).
J. Phys. A (GB), vol.16, no.7, p.1377-82 (11 May 1983).
By decomposing the adjoint and lowest dimensional representations of the exceptional Lie algebra F_4 in the reduction $F_4 \rightarrow SO_3$, a boson realisation of a F_4 generator basis is established on account of a standard tensor operator formalism. Such a basis clearly exhibits the non-trivial vanishing of two 6*j* coefficients (discarding Regge symmetries), a property which is closely related to the possible embedding of F_4 into SO_{26}. Prospects for the occurrence of more non-trivial zeros, related to exception groups of higher rank, are indicated. (8 refs.)

64722 Representation of quantum mechanical wavefunctions by transformation generators. II. One-dimensional time-dependent case. C.Jung, H.Kruger (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
J. Phys. A (GB), vol.16, no.7, p.1397-408 (11 May 1983).
For pt.I see ibid., vol.16, no.11, p.3509-23 (1982). Sufficient conditions are given for constructing quantum mechanical wavefunctions by the sole knowledge of an appropriate sequence of classical canonical transformations which map a given Hamiltonian onto the new position variable. The transformation kernel for each individual step of this sequence is given by the semiclassical limit expression; it is a function of the generator of this transformation step only. The transformation kernel for the total transformation and the time-dependent wavefunction are obtained as a multiple integral over the product

of the transformation kernels of the various intermediate steps. The practicability of this procedure is demonstrated by several examples. The authors consider explicitly time-dependent systems with one degree of freedom. (10 refs.)

64723 Laplace transform method for scattering on Coulomb plus nonlocal separable potentials. D.K.Ghosh, M.R.Sinha, B.Talukdar (Dept. of Phys., Visva-Bharati Univ., Santiniketan, India).

J. Phys. A (GB), vol.16, no.7, p.1529-37 (11 May 1983).

A Laplace transform method is derived to solve the Schrodinger equation for the Coulomb plus Tabakin potentials with the regular boundary condition. The results are used to construct expressions for on- and off-shell Jost functions in terms of Gaussian hypergeometric functions. (20 refs.)

64724 The accidental degeneracy problem in nonrelativistic quantum mechanics. A.Khare (Dept. of Theoretical Phys., Univ. of Manchester, Manchester, England).

J. Math. Phys. (USA), vol.24, no.4, p.867-73 (April 1983).

The author shows that the class of potential given by $V(r)=Ar^{2d-2}-Br^{d-2}$ possesses partial accidental degeneracy given by $E_{n1,l2}=E_{n2,l1}$ in case $d=(l_2=l_1)/(n_2-n_1)$, $B=[l+dn+(1-d)/2]\times(2A/\mu)^{1/2}$. It is further shown that, for a given potential, as the number of dimensions change, the accidential degeneracy pattern also changes except when $d=1$ and 2. Using these results, it is then shown that for the bottom quark-antiquark ($b\bar{b}$) bound system, most likely $E_{3S}<E_{1F}<E_{2D}$. Finally he also makes some conjectures about the ordering of levels for a wide class of potentials. (10 refs.)

64725 Remarks on canonical transformations in phase-space path integrals. C.C.Gerry (Div. of Sci. & Math., Univ. of Minnesota, Morris, MN, USA).

J. Math. Phys. (USA), vol.24, no.4, p.874-7 (April 1983).

The author studies canonical transformations in phase-space path integrals in the Schrodinger representation. Using the example of a contact transformation implemented in each short-time propagator via the midpoint method, he shows that the 'measure' $(dp_N/2\pi\hbar)\Pi_{j=1}{}^{N}\ [dp_jdq_j/(2\pi\hbar)]$, apart from the unpaired dp_N, cannot be considered as a product of Liouville measures. (14 refs.)

64726 A recurrence relation for the phase shifts of exponential and Yukawa potentials. B.G.Sidharth (Scuola Internazionale Superior di Studi Avanzati, Trieste, Italy).

J. Math. Phys. (USA), vol.24, no.4, p.878-82 (April 1983).

Using the Born approximation for high energies, the author deduces a recurrence relation for the higher order phase shifts Yukawa and exponential potentials and their superpositions. Thence a formula for the total cross section is deduced. It is shown that these formulae are particularly useful when the energy is very high. Next, using the low energy technique of expansion in powers of the energy, the author deduces an asymptotic formula when l is large, for δ_{l+1}/δ_l. The remarkable thing is that the recurrence relation is identical to the asymptotic formula. It is verified that the formulae for the phase shifts give satisfactory results, which are better than the Born approximation, from $l=1$ onwards, for scattering by helium and hydrogen atoms, while the formula for the total cross section gives better results than an improved variational technique or the Born approximation. (12 refs.)

64727 Time evolution kernels: uniform asymptotic expansions. T.A.Osborn (Dept. of Phys., Univ. of Manitoba, Winnipeg, Manitoba, Canada), Y.Fujiwara.

J. Math. Phys. (USA), vol.24, no.5, p.1093-103 (May 1983).

For a wide class of self-adjoint Schrodinger Hamiltonians, a detailed description of the time evolution kernel is obtained. In a setting of a d-dimensional Euclidean space without boundaries, the Schrodinger Hamiltonian H is the sum of the negative Laplacian plus a real-valued local potential $v(x)$. The class of potentials studied is the family of bounded and continuous functions that are formed from the Fourier transforms of complex bounded measures. These potentials are suitable for the N-body problem, since they do not necessarily decrease as $|x|\to\infty$. An asymptotic expansion in the complex parameter z, around $z=0$, is derived for the family of kernels $U_z(x,y)$ corresponding to the analytic semigroup $\{e^{-zH}:\mathrm{Re}\ z>0\}$, which is uniform in the coordinate variables x and y. The asymptotic expansion has a simple semiclassical interpretation. Furthermore, an explicit bound for the remainder term in the asymptotic expansion is found. The expansion and the remainder term bound continue to the time axis boundary $z=it/\hbar(t\neq0)$ of the analytic semigroup domain. (20 refs.)

64728 Time evolution of the Wigner function. F.Soto-Eguibar, P.Claverie (Lab. de Chimie Quantique, Inst. de Biologie Phys.-Chimique, Paris, France).

J. Math. Phys. (USA), vol.24, no.5, p.1104-9 (May 1983).

The authors give a partial answer to the problem: when does an initially non-negative Wigner function remain non-negative under the effect of the time evolution? They show that, for pure states, this is the case for linear systems only; to prove this they use the fact that the Wigner function is non-negative if and only if the wavefunction is Gaussian. The authors also prove that the Green's solution of the evolution equation of the Wigner function, which in the framework of probability theory corresponds to the conditional probability density, takes on negative values. They utilize a theorem, about moments, borrowed from Pawula (1965, 1967). They conclude that the Wigner phase-space formulation of quantum mechanics cannot receive a genuine probabilistic interpretation. (17 refs.)

64729 Transfer matrices for one-dimensional potentials. A.Peres (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).

J. Math. Phys. (USA), vol.24, no.5, p.1110-19 (May 1983).

The one-dimensional Schrodinger equation can be written as a first-order multicomponent equation by considering ψ and $d\psi/dx$, or combinations thereof, as independent variables. A potential barrier is then represented by a matrix belonging to one of the homomorphic groups SU(1,1), SO(2,1), Sp(2,R), or SL(2,R). The relationship between these groups is clarified. In various applications, one of them may turn out more convenient than others. In particular, SO(2,1), which is obtained by using as a basis some bilinear combinations of ψ and $d\psi/dx$, leads to remarkable results: the Schrodinger wavefunction is represented by a trajectory on a unit hyperboloid; a periodic potential corresponds to a pseudorotation around a fixed axis; a random potential gives a random walk on the hyperboloid. This method can also be used to calculate bound states (in potential wells) and may have many other interesting applications. (26 refs.)

64730 A probabilistic formulation of quantum theory. III. T.Wenning, A.Bach (Inst. fur Theoretische Phys., Univ. Munster, Munster, Germany).

J. Math. Phys. (USA), vol.24, no.5, p.1120-2 (May 1983).

For pt.II see ibid., vol.23, p.1078 (1982). A representation of the expectation value of quantum mechanics, which recently has been set up for normal states, is generalized to singular states. It is shown that states can be represented by finitely additive measures on the state space, which are σ-additive if and only if the states are normal. (10 refs.)

64731 · Nonlinear time-dependent anharmonic oscillator: asymptotic behavior and connected invariants. D.Besnard, J.R.Burgan, A.Munier (CEA Limeil, Villeneuve St Georges, France), M.R.Feix, E.Fijalkow.

J. Math. Phys. (USA), vol.24, no.5, p.1123-8 (May 1983).

The motion of a particle in a potential decreasing with time as $|X|^n$ is considered. Different time and space rescaling are considered in order to obtain the asymptotic solutions. The validity of adiabatic invariants is discussed. The classical critical case corresponds to the obtainment of self-similar solutions for the quantum problem. (7 refs.)

64732 Complex-potential description of the damped harmonic oscillator. P.Exner (Lab. of Theoretical Phys., JINR, Dubna, USSR).

J. Math. Phys. (USA), vol.24, no.5, p.1129-35 (May 1983).

The multidimensional damped harmonic oscillator is treated by means of a non-self-adjoint Hamiltonian with complex potential. The propagator referring to the evolution semigroup is evaluated from the Lie-Trotter formula. The one-dimensional case is discussed in detail with the following results: (a) the nondamped limit gives the correct propagator including the Maslov phase factor, (b) for some initial conditions, the classical limit of the solution can differ from the behavior of the classical damped oscillator, the difference being negligible in the case of weak damping, and (c) the point spectrum of the considered pseudo-Hamiltonian is found. (32 refs.)

64733 Extended continued fractions and energies of the anharmonic oscillators. M.Znojil (Nuclear Phys. Inst., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).

J. Math. Phys. (USA), vol.24, no.5, p.1136-41 (May 1983).

The author describes the analytic solution to the Schrodinger eigenvalue problem for the class of the central potentials $V(r)=\Sigma_{\delta\epsilon Z}a_\delta r^\delta$, where $a_{-2}>-1/4$, $a_{\max\delta}>0$, Z is an arbitrary finite set of the integer or rational exponents, $-2\leq\delta_1<\delta_2<\ldots<\delta_l$, and the couplings a_δ satisfy only one auxiliary (formal, 'superconfinement') restriction of the type $a_{\delta l-1}>0$. The formalism is based on an analysis of the asymptotic behavior of the explicit regular solution $\psi(r)$ and issues in the formulation of the 'secular' equation $1/L_1(E)=0$ which determines the binding energies. The main result is the rigorous construction of $L_1(E)$ is a generalized ('extended') and convergent continued fraction. The method cannot be applied to the $a_{\delta l-1}<0$ cases—this disproves the closely related Hill-determined approach as conjectured recently by Singh et al. (1978, 1979, 1980) for the simplest potentials with $Z=\{-2,2,4,6\}$ and $Z=\{-2,-1,1,2\}$. (16 refs.)

64734 On the number of unnatural parity bound states of the H⁻ ion. H.Grosse (Inst. fur Theoretische Phys., Univ. of Wien, Wien, Austria), L.Pittner.

J. Math. Phys. (USA), vol.24, no.5, p.1142-7 (May 1983).

The authors show rigorously that the H^- ion possesses exactly one (three times degenerate) bound state in the unnatural parity sector. (12 refs.)

64735 Inverse scattering for the reflectivity function. S.H.Gray (Amoco Production Co., Tulsa, OK, USA).

J. Math. Phys. (USA), vol.24, no.5, p.1148-51 (May 1983).

An inverse method for elastic, electromagnetic, or acoustic waves in a stratified half-space is presented. Rather than transforming the wave equation to one for which quantum inverse scattering methods can be applied in solving for a potential $q(\tau)$, the author transforms to one where it is suitable to solve for a 'reflectivity function', or local reflection coefficient, $\gamma(\tau)$. The author shows that $\gamma(\tau)$ can be discontinuous, thus improving a result of Balanis (1982) and that discontinuities of $\gamma(\tau)$ match those of the impulse response $R(t)$. The author also shows the relationship between the scattering kernel of this method and the scattering kernel of the quantum inverse scattering theory. (11 refs.)

64736 The Coulomb Jost states in the momentum representation for all partial waves in closed form. H.van Haeringen (Dept. of Math., Delft Univ. of Technol., Delft, Netherlands).

J. Math. Phys. (USA), vol.24, no.5, p.1152-6 (May 1983).

The author obtains the Coulomb Jost states in the momentum representation for all l in exact closed form. These closed expressions consist of combinations of the function ${}_2F_1(1,i\gamma;\ 1+i\gamma;.)$, Jacobi polynomials, and other polynomials. The author also discusses the relation of the Coulomb Jost states with other quantities that are of interest in the theory of charged-particle scattering. (8 refs.)

64737 The unitarity relations for the off-shell Coulomb T matrix for all partial waves. H.van Haeringen (Dept. of Math., Delft Univ. of Technol., Delft, Netherlands).

J. Math. Phys. (USA), vol.24, no.5, p.1157-9 (May 1983).

By employing a recently obtained expression for the partial-wave projection of the off-shell Coulomb T matrix for all l the author proves that the unitarity relations for the Coulomb T matrix hold provided that they are properly modified with the help of Coulombian asymptotic states. (12 refs.)

64738 Existence and uniqueness of bound-state eigenvectors for some channel coupling Hamiltonians. J.W.Evans (Dept. of Chem., Iowa State Univ., Ames, IA, USA).

J. Math. Phys. (USA), vol.24, no.5, p.1160-2 (May 1983).

For the three-particle, two-cluster, 2×2 channel coupling Hamiltonians used, e.g. in $H_2{}^+$ and He bound-state calculations, the author demonstrates that typically there exist unique eigenvectors for all bound states. This result also holds, with some technical assumptions on the potentials, for the corresponding 3×3 case provided there are no spurious eigenvectors with bound-state eigenvalues. The proofs use the analogous results for the corresponding Faddeev-type Hamiltonians together with spurious multiplier relationships. (16 refs.)

64739 Off-shell T matrix for Coulomb plus simple separable potentials for all l in closed form. H.van Haeringen (Dept. of Math., Delft Univ. of Technol., Delft, Netherlands).

J. Math. Phys. (USA), vol.24, no.5, p.1274-81 (May 1983).

The author derives simple exact analytic expressions for the off-shell T matrices associated with potentials consisting of the sum of the Coulomb potential and any so-called simple separable potential, for all partial waves. Such potentials play an important role in model calculations for the description of the interaction between charged particles, e.g. protons. The author also derives some interesting properties of the Coulomb-modified form factors associated with the form factors of the separable potentials. The analytic expressions obtained are useful for theoretical and numerical applications. (12 refs.)

64740 Comment on the paper: 'Necessary conditions on potential functions for nonrelativistic bound states' by Gerald Rosen. V.Glaser, A.Martin (CERN, Geneva, Switzerland).

Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.16, p.519-20 (16 April 1983).

The authors discover that the paper of G. Rosen (1982) with the above-mentioned title contains no new result. The sufficient condition for the absence of bound state in a three-dimensional potential $\int|V|^{3/2}d^3x<3\sqrt{3}/4\pi^2$ was established in 1976 by Grosse, Thirring and by the authors and tested on various examples. A self-contained proof of the optimality of the relevant Sobolev inequality is presented by Glaer et al. (1976). The previous work of Rosen (1971) does not contain a complete proof, since spherical symmetry is postulated without the justification which is supplied by Glaser et al. and since it is only the existence of a local minimum which is established. (7 refs.)

64741 The Caldirola-Montaldi procedure and the *Q*-analysis are noncanonical theories in time. A.D.Jannussis, G.N.Brodimas, V.Papatheou, A.Leodaris (Dept. of Theoretical Phys., Univ. of Patras, Patras, Greece).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.545-50 (23 April 1983). (17 refs.)

64742 Electromagnetic binding with only zero orbital angular momentum, low-energy states. G.B.Mainland, D.M.Scott (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.198-208 (21 March 1983).
Investigates bound states of a composite system consisting of a charged particle orbiting a charged, stationary magnetic dipole. The authors find bound states with zero orbital angular momentum but, for a specific range of a parameter, they find no other states with orbital angular momentum less than eleven. The states with zero orbital angular momentum are the most tightly bound. If this mechanism were operable in a realistic composite model of leptons, it could explain why the electron, muon and tau all have spin $^1/_2$. They also suggest a mechanism which may explain the absence or suppression of the decay of a muon into an electron and a photon. Their calibration is nonrelativistic and is performed in two space dimensions. (12 refs.)

64743 Obtaining non-negative quantum mechanical distribution function. P.Bertrand, J.P.Doremus, B.Izrar, V.T.Nguyen (Lab. de Phys. Theorique, Univ. de Nancy I, Vandoeuvre, France), M.R.Feix.
Phys. Lett. A (Netherlands), vol.94A, no.9, p.415-17 (4 April 1983).
The distribution function obtained by smoothing the original Wigner function with a weighting function, is shown to be positive everywhere, if the weighting function itself is a Wigner transform of any normalised function. The marginal distribution is recovered with a special choice of this function. (16 refs.)

64744 Quantum energy-entropy balance and breaking of symmetries. M.Fannes, P.Vanheuverzwijn, A.Verbeure (Inst. voor Theoretische Fysica, Univ. Leuven, Leuven, Belgium).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.418-20 (4 April 1983).
A method, based on a general energy-entropy inequality, is presented to rule out spontaneous breaking of discrete and continuous symmetries. As an application the authors prove rigorously the homogeneity of the correlation functions for one-dimensional long-range quantum lattices. (16 refs.)

64745 Resonances and asymptotic behavior of Birkhoff series. G.Servizi, G.Turchetti (Istituto di Fisica, Univ. di Bologna, Bologna, Italy), G.Benettin, A.Giorgilli.
Phys. Lett. A (Netherlands), vol.95A, no.1, p.11-14 (11 April 1983).
For hamilton systems with two degrees of freedom a mechanism accounting for the divergence of perturbation series and the asymptotic relation between true and formal dynamics is proposed. In the special case of conservative quadratic maps numerical and analytical support is given for a piecewise geometric structure of the Birkhoff series, that is a sequence of pseudoconvergence radii is found which decreases to zero and is associated with the resonances approaching the rotation angle of the linear map. (12 refs.)

64746 Structure and stability of the quasi-energy spectrum of two interacting quantum nonlinear resonances. G.P.Berman, A.R.Kolovsky (Kirensky Inst. of Phys., Krasnoyarsk, USSR).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.15-18 (11 April 1983).
The numerical analysis of the structure and stability of the quasi-energy spectrum of two interacting quantum nonlinear resonances is carried out. It is shown that when resonances overlap and a sufficiently large number of levels participate in the dynamics of the system the quasi-energy spectrum is weakly unstable at a small variation of the parameters of the system. This leads to a strong instability of the frequency spectrum of amplitudes of the populations. (5 refs.)

64747 Comment on 'quantum nondemolition measurements'. J.D.Macomber (Chem. Dept., Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.19-20 (11 April 1983).
It is shown that the new term 'quantum nondemolition measurements' may be applied to a magnetic-resonance gedanken-experiment first described by the author in 1976. (5 refs.)

64748 On resolvent operators in scattering theory. S.K.Adhikari (Dept. de Fisica, Univ. Federal de Pernambuco, Recife, Brazil).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.21-2 (11 April 1983).
It is shown that, contrary to recent claims, the usual definition of resolvent operators in scattering theory is correct. (10 refs.)

64749 Chaos in a perturbed nonlinear Schrodinger equation. K.Nozaki, N.Bekki (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1226-9 (25 April 1983).
It is shown that a nonlinear Schrodinger soliton behaves stochastically with random phases in both time and space in the presence of small external oscillating fields and emits small-amplitude plane waves with random phases. Statistical properties of random phases give the energy spectra of the soliton and plane waves. (9 refs.)

64750 Some evaluations of Bell's inequality for particles of arbitrary spin. M.Ogren (Inst. of Theoretical Phys., Goteborg, Sweden).
Phys. Rev. D (USA), vol.27, no.8, p.1766-73 (15 April 1983).
Bell's inequality is applied to a gedanken experiment, where a spin singlet decays into two spin-*s* particles. This is done by defining dichotomic observables depending on the spin components. The range of settings, for which the inequality is violated by quantum mechanics is calculated for certain values of *s*. The classical limit is taken and the results are compared to those obtained, by an alternative method, by Mermin (1980). (15 refs.)

64751 Quantisation of dynamical systems and stochastic control theory. F.Guerra, L.M.Morato (Centre de Phys. Theorique, CNRS, Marseille, France).
Phys. Rev. D (USA), vol.27, no.8, p.1774-86 (15 April 1983).
In the general framework of stochastic control theory the authors introduce a suitable form of stochastic action associated to the controlled process. A variational principle gives all the main features of Nelson's stochastic mechanics. In particular, they derive the expression for the current velocity field as the gradient of the phase action. Moreover, the stochastic corrections to the Hamilton-Jacobi equation are in agreement with the quantum-mechanical form of the Madelung fluid (equivalent to the Schrodinger equation). Therefore, stochastic control theory can provide a very simple model simulating quantum-mechanical behaviour. (34 refs.)

64752 Improved semiclassical approximation. A.Patrascioiu (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1798-802 (15 April 1983).
A modification of the semiclassical method, applicable in massless theories, is proposed. It is shown that in 0 and 1 dimensions this approximation produces excellent numerical agreement with the exact or otherwise-computed results. The generalisation to higher dimensions is discussed. (11 refs.)

64753 Planar rotor: The θ-vacuum structure, and some approximate methods in quantum mechanics. M.Asorey (Dept. de Fisica Teorica, Univ. de Zaragoza, Zaragoza, Spain), J.G.Esteve, A.F.Pacheco.
Phys. Rev. D (USA), vol.27, no.8, p.1852-68 (15 April 1983).
The quantum planar rotor is chosen as a model to test different approximate techniques, emphasizing the analogies between this simple system and the non-Abelian quantum gauge field theories (instantons, θ vacuum, etc.). In particular, variational and perturbative methods, path-integral techniques, and Monte Carlo simulations are applied. It is pointed out that the maximal destructive interference between instantons takes place in the θ-vacuum realization of the interacting rotor system with $\theta=1/2$, where the tunneling effects are shown to be severely diminished. (20 refs.)

64754 Potential scattering at high energy: Gaussian potential. T.W.Chen (California Inst. of Technol., Pasadena, CA, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1869-77 (15 April 1983).
A new formula for the elastic scattering amplitude by a potential is found. It is based on the usual eikonal-approximation scheme except that the linearized propagation in the scattering region is chosen to be along the average direction of the initial and final momenta at every step of the derivation. The projectile thus moves in a classical-refraction trajectory. The new formula is tested numerically for Gaussian potentials. It is found to work remarkably well for a wide range of angles. (7 refs.)

64755 A nonlocal equation for the wave function of the harmonic oscillator when the position spectrum is to be made discrete. R.G.Campos (Escuela de Fisico-Matematicas, Univ. Michoacana de San Nicolas de Hidalgo, Morelia, Mexico).
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.217-36 (Feb. 1983).
A discrete spectrum for position and a nonlocal equation for the wave function with its respective solutions are obtained, in a trivial way, by replacing the usual position and momentum operators by finite matrices, obtained by truncating the infinite matrices for these operators in the energy representation. Some extremal properties of the energy eigenfunctions and of the position eigenvalues are shown. (7 refs.)

64756 Construction of effective operators for the time-dependent Schrodinger equation. V.I.Zakharov, Vl.G.Tyuterev (Inst. of Atmospheric Optics, Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.749-52 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.78-81 (Aug. 1982). [received: April 1983]
The contact transformation method is used to solve the time-dependent Schrodinger equation describing the behavior of a multilevel system in a resonance electromagnetic field. A solution not containing secular terms is obtained for the evolution operator in the interaction representation U_0. The derivation of the equation for the probability of the simultaneous absorption of two photons with the dipole interaction is presented as an example of the effectiveness of the obtained solution. (6 refs.)

64757 Influence of an abrupt drop in potential on particle motion. S.B.Nurmagambetov (S.M. Kirov Polytech. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.676-80 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.102-6 (July 1982). [received: May 1983]
The motion of particles in potentials which become minus infinity at some point has been investigated. It is shown that the state localized at the point of the potential drop is the ground state of the particle; for excited states, whose wave functions do not vanish at the point where the potential drops, the fairly abrupt potential drop is equivalent to the existence of a potential barrier at that point. (3 refs.)

64758 Momentum, energy and entropy in the complex continued Schrodinger configuration plane. J.G.Gilson (Dept. of Appl. Math., Queen Mary Coll., London, England).
Speculations Sci. & Technol. (Switzerland), vol.6, no.1, p.45-54 (April 1983).
The author constructs a classical fluid alternative to conventional Schrodinger quantum theory. The equations of conservation for momentum, energy and entropy over the complex continued configuration plane are all obtained with their appropriate source functions. It is shown how all these source functions are derivable from the fundamental source function for local mass production, Γ. (11 refs.)

64759 Path integrals in problems with boundaries. L.V.Prokhorov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.14-20 (Feb. 1983). In Russian.
The problem of a particle in the n-dimensional box is considered using the path integral method. The general form of solution has been found. (8 refs.)

64760 Dirichlet and Von Neumann basis set for quantum mechanical anharmonic oscillators. A.M.Meson, F.M.Fernandez, E.A.Castro (Seccion Quimica Teorica, INIFTA, La Plata, Argentina).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.473-6 (April 1983).
It is shown that accurate upper and lower bounds to the eigenvalues of anharmonic oscillators can be obtained by means of the Rayleigh-Ritz variational method and two trigonometric basis sets of functions which satisfy Dirichlet and Von Neumann boundary conditions. Numerical results show that the Dirichlet basis set is more appropriate than the harmonic oscillator one for calculating eigenvalues and the value of eigenfunctions at the origin. (12 refs.)

64761 Finite element interpolation error bounds with applications to eigenvalue problems. P.Arbenz (Inst. fur Angewandte Math., Univ. Zurich, Zurich, Switzerland).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.180-91 (March 1983).
Optimal finite element interpolation error bounds are presented for piecewise linear, quadratic and Hermite-cubic elements in one dimension. These bounds can be used to compute upper and lower bounds for eigenvalues of second and fourth order elliptic problems. Numerical computations demonstrate the usefulness of the theoretical results. (17 refs.)

Second quantization in nonrelativistic quantum mechanics ....See Entry 64608
The physics behind path integrals in quantum mechanics ....See Entry 64613
Expression for y_{LM} [$(r_1 \wedge r_2) \wedge r_3$] ....See Entry 64647
Some infinite series of products of Legendre and gamma functions ....
....See Entry 64655
Tracing complex singularities with spectral methods ....See Entry 64659
Formal state determination ....See Entry 64820

The partial-wave projected Coulomb *T* matrix for all *l* in closed hypergeometric form .... See Entry 65068

On the complex angular momentum theory of scattering .... See Entry 65078

Semiclassical many-mode Floquet theory .... See Entry 66244

Electron mobility in gases at low temperatures: the quantum mechanical Lorentz gas. I .... See Entry 66666

03.80 GENERAL THEORY OF SCATTERING

(see also 11.20 S-matrix theory, and 11.80 Relativistic scattering)

64762 The analytical expression for the two-particle Coloumb Green's function with explicitly separated singularities. S.A.Shadchin (Inst. for Nuclear Res., Acad. of Sci., Kiev, Ukrainian SSR), V.F.Kharchenko.
J. Phys. B (GB), vol.16, no.8, p.1319-22 (28 April 1983).
The problem of Coulomb scattering of two particles off the energy shell is considered. A new analytical expression for the two-particle Coulomb Green's function with explicitly separated singularities in the variables of the transfer momentum and the energy is obtained in the case of negative energy. (13 refs.)

The Aharonov-Bohm effect and scattering theory .... See Entry 64707

04.00 RELATIVITY AND GRAVITATION

(for special relativity, see 03.30; for relativistic astrophysics, see 95.30; for relativistic cosmology, see 98.80)

04.20 GENERAL RELATIVITY

(see also 02.40 Geometry and topology)

64763 On the structure of space-time caustics. K.Rosquist (Dept. of Appl. Math., Queen Mary Coll., London, England).
Commun. Math. Phys. (Germany), vol.88, no.3, p.339-55 (March 1983).
Caustics formed by timelike and null geodesics in a space-time M are investigated. Care is taken to distinguish the conjugate points in the tangent space (T-conjugate points) from conjugate points in the manifold (M-conjugate points). It is shown that most nonspacelike conjugate points having the same degree of degeneracy. The regular timelike T-conjugate locus is shown to be a smooth 3-dimensional submanifold of the tangent space. Analogously, the regular null T-conjugate locus is shown to be a smooth 2-dimensional submanifold of the light cone in the tangent space. The smoothness properties of the null caustic are used to show that if an observer sees focusing in all directions, then there will necessarily be a cusp in the caustic. If, in addition, all the null conjugate points have maximal degree of degeneracy (as in the closed Friedmann-Robertson-Walker universes), then the space-time is closed. (14 refs.)

64764 Gravitational field equations based on Finsler geometry. G.S.Asanov (Dept. of Theoretical Phys., Moscow State Univ., Moscow, USSR).
Found. Phys. (USA), vol.13, no.5, p.501-27 (May 1983).
The Finslerian generalisation of the gravitational field equations is developed on the basis of the complete contraction $K=K_{ij}{}^{ij}$ of the Finslerian curvature tensor $K_i{}^j{}_{hk}(x, y)$. The relevant Lagrangian is constructed by the replacement of the directional variable y^i in K by a vector field $y^i(x)$, so that the notion of osculation may be regarded as the key concept on which the approach is based. The introduction of the auxiliary vector field $y^i(x)$ is shown to be of physical significance, for the field equations refer not only to the proper field variables but also to a special coordinate system associated with $y^i(x)$ through the Clebsch representation of the latter. The status of the conservation laws proves to be similar to that in the theory of the Yang-Mills field. By choosing a special Finslerian metric function the authors elucidate in detail the structure of the field equations in the static case. (15 refs.)

64765 A fundamental quadratic variational principle underlying general relativity. W.K.Atkins (Dept. of Phys., North Carolina State Univ., Raleigh, NC, USA).
Found. Phys. (USA), vol.13, no.5, p.545-52 (May 1983).
The fundamental result of Lanczos (1962) is used in a new type of quadratic variational principle whose field equations are the Einstein field equations together with the Yang-Mills type equations for the Riemann curvature. Additionally, a spin-2 theory of gravity for the special case of the Einstein vacuum is discussed. (28 refs.)

64766 Black holes and the stability of gravitation. G.T.Horowitz (Inst. for Advanced Study, Princeton, NJ, USA), M.J.Perry.
Gen. Relativ. & Gravitation (USA), vol.15, no.1, p.1-5 (Jan. 1983).
The existence of black holes in general relativity provides an effective cutoff to the negative gravitational potential. This results in a fundamental upper limit on the amount of energy that can be radiated away by any isolated system. (11 refs.)

64767 Novikov-type coordinates for HJ separable metrics. S.Gupta, N.Mitskievic (Dept. of Theoretical Phys., Patrice Lumumba Peoples' Friendship Univ., Moscow, USSR).
Gen. Relativ. & Gravitation (USA), vol.15, no.1, p.7-19 (Jan. 1983).
Synchronous frames are known to remove (at least partially) deficiencies inherent in Killing coordinates. Strangely enough, no constructive general method of finding these frames has been formulated, though it follows from the definition of synchronous coordinates. The authors propose here such a method and apply it to the Kerr metric to obtain a Novikov-type synchronous frame. The removal of nonphysical singularities is discussed in the context of 3-metric and 3-curvature on the spatial hypersurfaces in this frame. (14 refs.)

64768 The topology of geodesically complete space-times. C.W.Lee (Dept. of Math., Bolton Inst. of Technol., Bolton, England).
Gen. Relativ. & Gravitation (USA), vol.15, no.1, p.21-30 (Jan. 1983).
Two theorems are given on the topology of geodesically complete space-times which satisfy the energy condition. Firstly, the condition that a compact embedded 3-manifold in space-time be dentless is defined in terms of causal structure. Then it is shown that a dentless 3-manifold must separate space-time, and that it must enclose a compact portion of space-time. Further, it is shown that if the dentless 3-manifold is homeomorphic to S^3 then the part of space-time that it encloses must be simply connected. (16 refs.)

64769 The equivalence of perfect fluid space-times and magnetohydrodynamic space-times in general relativity. B.O.J.Tupper (Dept. of Math. & Statistics, Univ. of New Brunswick, Fredericton, New Brunswick, Canada).
Gen. Relativ. & Gravitation (USA), vol.15, no.1, p.47-64 (Jan. 1983).
It is shown that perfect fluid space-times can also satisfy the field equations for a magnetohydrodynamic fluid. The necessary conditions for this equivalence are found and the magnetohydrodynamic interpretations of the zero-curvature FRW model with equation of state $\rho=3p$, and of the Godel model are given. (5 refs.)

64770 Perfect fluid spheres in general relativity. D.C.Srivastava, S.S.Prasad (Dept. of Phys., Univ. of Gorakhpur, Gorakhpur, India).
Gen. Relativ. & Gravitation (USA), vol.15, no.1, p.65-77 (Jan. 1983).
Spherically symmetric perfect fluid distributions in general relativity have been investigated under the assumptions of (i) uniform expansion or contraction and (ii) the validity of an equation of state of the form $p=p(\rho)$ with nonuniform density. An exact solution which is equivalent to a solution found earlier by Wyman (1946) is obtained and it is shown that the solution is unique. The boundary conditions at the interface of fluid distribution and the exterior vacuum are discussed and as a consequence the following theorem is established: Uniform expansion or contraction of a perfect fluid sphere obeying an equation of state with nonuniform density is not admitted by the field equations. It is further shown that the Wyman metric is not suitable on physical grounds to represent a cosmological solution. (10 refs.)

64771 Scalar-tensor theory of gravitation: generalizations and experimental limitations. J.P.Duruisseau (Dept. de Mecanique, Univ. Pierre et Marie Curie, Paris, France).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.285-92 (April 1983).
Several theories with scalar field can be derived from different variational principles. The author considers a very general variational principle and proves that, in the exterior case without electromagnetic field, the solution for a particular case generates the set of solutions for the general case. This is applied to the exterior solution in the static case with spherical symmetry without electromagnetic field. The author investigates the predictions for the classical effects and the event horizons. (19 refs.)

64772 Conformal flat interior solutions for a charged sphere. Zhu Shi-chang (Dept. of Phys., Shanghai Teachers Coll., Shanghai, China).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.293-303 (April 1983).
The author has obtained conformal flat interior solutions of the Einstein-Maxwell equations for a charged stable static sphere. These solutions satisfy physical conditions inside the sphere. (12 refs.)

64773 Nonstatic solutions for the repulsive massless scalar field Einstein equation. H.Ishikawa (Dept. of Phys., Nagoya Univ., Nagoya, Japan).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.305-7 (April 1983).
The author presents exact nonstatic solutions for the coupled repulsive sourceless massless scalar field and the gravitational field. The solutions have the same form as the spatially conformally flat static metric $ds^2=-e^{2\psi}dt^2+e^{-2\psi}(dx^2+dy^2+dz^2)$. (3 refs.)

64774 Classical and quantum models of strong cosmic censorship. V.E.Moncrief (Dept. of Phys., Yale Univ., New Haven, CT, USA).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.309-14 (April 1983).
The cosmic censorship conjecture states that naked singularities should not evolve from regular initial conditions in general relativity. In its strong form the conjecture asserts that space-times with Cauchy horizons must always be unstable and thus that the generic solution of Einstein's equations must be inextendible beyond its maximal Cauchy development. The author shows that one can construct an infinite-dimensional family of extendible cosmological solutions similar to a Taub-NUT space-time. (7 refs.)

64775 Space-time in ordered electromagnetic radiation outside a massive plane. P.A.Amundsen, O.Gron (Inst. of Phys., Univ. of Oslo, Oslo, Norway).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.315-19 (April 1983).
The Einstein-Maxwell equations are solved with an energy-momentum tensor corresponding to the field of a standing electromagnetic wave outside a massive plane, in the limit where the test particle is much larger than the wavelength of the electromagnetic field. Physical properties of the solution are discussed. (10 refs.)

64776 Geometrical mass of charged particle in Brans-Dicke theory. M.M.Som, N.S.Santos (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.321-8 (April 1983).
The authors develop a special class of solutions of the Brans-Dicke equations from vacuum solutions of Einstein's equations by applying a method due to Teixeira, Wolk, and Som. It is shown that the electric charge contributes positively to the geometric mass while the Brans-Dicke scalar field diminishes the geometric mass effectively. (4 refs.)

64777 Remark concerning spherically symmetric nonstatic solutions to the Einstein equations in the comoving frame. K.Lake (Dept. of Phys., Queen's Univ. Kingston, Kingston, Ontario, Canada).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.357-61 (April 1983).
All nonstatic spherically symmetric fluid solutions to the Einstein equations in the comoving frame $ds^2=e^{\lambda(r,t)}dr^2\ e^{\mu(r,t)}d\Omega^2-e^{\nu(r,t)}dt^2$ are found subject to the conditions: (i) $\dot{\lambda}=A\dot{\mu}$, A=const, (ii) λ, μ, and ν are separable functions of r and t, (III) the heat flux vanishes, and (iv) the coefficient of shear viscosity vanishes. There are but two classes of solutions: (i) $A=1$, in which case the metric reduces to the Robertson-Walker form, and (ii) $A=0$, in which case there are four solutions, all with nonvanishing acceleration, expansion, and shear. With $A=0$, the solutions are either singular at the origin or degenerate into spaces of constant curvature. (2 refs.)

64778 Third-order tensor potentials for the Riemann and Weyl tensors. F.Bampi, G.Caviglia (Istituto Matematico, Univ. de Genova, Genova, Italy).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.375-86 (April 1983).
The representations of the Riemann and the Weyl tensors of a four-dimensional Reimannian manifold through covariant derivatives of third-order potentials are examined in detail. The Weyl tensor always admits a completely general representation whereas the Riemann tensor does not. Nevertheless there exists a class of Riemannian manifolds whose Riemann tensors may be calculated in terms of potentials; in this connection, specific examples are exhibited explicitly. The possibility of introducing gauges on the potentials is reexamined in connection with the previous result. New properties of the representations are also discussed. (13 refs.)

64779 Momentum, angular momentum and their quasi-local null surface extensions. M.Ludvigsen, J.A.G.Vickers (Dept. of Math., Univ. of York, York, England).
J. Phys. A (GB), vol.16, no.6, p.1155-68 (21 April 1983).
Let M be an asymptotically flat space-time which satisfies the dominant energy condition and let $\mathcal{N}$ be a null hypersurface of M which meets $\mathscr{I}^+$ in a space-like cross section S given by $r=\infty$, where r is an affine parameter along the generators of $\mathcal{N}$. It is shown that there exists a quasi-local momentum $P_a(r)$, defined by means of an integral over the r=constant cross sections

of $\mathcal{N}$, which tends to the Bondi momentum as $r \to \infty$, and which satisfies the radial 'mass-gain condition' $P_a(r_2)k^a \geq P_a(r_1)k^a$ when $r_2 \geq r_1$, where k^a is a constant future pointing null vector. This condition is then used to show that, in certain circumstances, the Bondi momentum is always future pointing or, in other words, that the Bondi mass is always positive. A quasi-local angular momentum is also defined, which tends to Bramson's (1975) angular momentum as $r \to \infty$. (12 refs.)

64780 An inequality relating mass and electric charge in general relativity. M.Ludvigsen (Dept. of Math., Univ. of Canterbury, Christchurch, New Zealand), J.A.G.Vickers.

J. Phys. A (GB), vol.16, no.6, p.1169-74 (21 April 1983).

The authors show that the total mass and electric charge of an isolated gravitating system satisfy the inequality $m \geq |e|$, provided all matter eventually becomes enclosed within a single trapped surface. (7 refs.)

64781 Colliding plane gravitational and electromagnetic waves. J.B.Griffiths (Dept. of Math., Loughborough Univ. of Technol., Loughborough, England).

J. Phys. A (GB), vol.16, no.6, p.1175-80 (21 April 1983).

A new class of type-II Einstein-Maxwell fields is presented. These describe the space-time subsequent to a collision of a gravitational wave with an electromagnetic wave. The gravitational wave is an arbitrary pp wave with generally non-constant polarisation. The incoming electromagnetic wave is also an arbitrary pp wave, and it is shown that this is partially reflected by the gravitational wave. (18 refs.)

64782 Left-flat spaces with non-diverging null geodesics. G.Ludwig (Dept. of Math., Univ. of Alberta, Edmonton, Alberta, Canada).

J. Phys. A (GB), vol.16, no.6, p.1181-9 (21 April 1983).

One of the two classes of non-divering algebraically special left-flat spaces found by Fette, Janis and Newman (1977) is generalised by allowing the (self-dual part of the) Weyl tensor to become algebraically general. Penrose's conformal approach is used, thereby allowing the desired asymptotic behaviour of the solutions to be prescribed from the outset. The 'solutions' are, however, still subject to some 'reduced equations'. For a specific choice of initial data at conformal null infinity these reduced equations simplify to Plebanski's (1975) second heavenly equation. (10 refs.)

64783 Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2). P.Hajicek (Inst. for Theoretical Phys., Univ. of Bern, Bern, Switzerland).

J. Phys. A (GB), vol.16, no.6, p.1191-205 (21 April 1983).

For pt.I see Bern Report BUTP-20 (1982). For a simple Einstein-Yang-Mills Higgs model, the author studies properties of the extreme wormhole solutions. As shown in a recent paper (1982), the values of all fields at the boundary of the hole must satisfy a system of differential equations. The author finds solutions to this system in a number of cases, among others a non-abelian family similar to the 't Hooft-Polyakov monopole. The author also proves that all solutions must be axisymmetric, and conjecture that the set of solutions which the author has found is already complete. (2 refs.)

64784 On the relativistic dynamics of spinning matter in space-time with curvature and torsion. A.V.Minkevich, F.Karakura (Dept. of Phys., Byelorussian State Univ., Minsk, Byelorussian SSR).

J. Phys. A (GB), vol.16, no.7, p.1409-18 (11 May 1983).

A variational formalism is developed for conservative systems with internal degrees of freedom in a space-time with curvature and torsion. Lagrange's translational and rotational equations of motion are obtained as well as expressions for the energy-momentum and spin angular momentum tensors; Noether's identities are derived. Some properties of the developed formalism are studied in greater detail. (15 refs.)

64785 Minimal surfaces, spatial topology and singularities in space-time. G.J.Galloway (Dept. of Math., Univ. of Miami, Coral Gables, FL, USA).

J. Phys. A (GB), vol.16, no.7, p.1435-9 (11 May 1983).

Using an approach first advocated by Gannon (1975, 1976) and recent results of Meeks, Simon and Yau (1982) on the existence of compact minimal surfaces some new results are obtained relating non-trivial spatial topology to the occurrence of singularities in space-time. For example, it is shown that if V^3 is a contracting body with mean-convex boundary homeomorphic to a two-sphere in a space-time M^4 obeying appropriate curvature and causality assumptions, then either V^3 is a three-cell or M^4 is non-space-like geodesically incomplete. (9 refs.)

64786 Nonlinear Lagrangians and pp waves. H.A.Buchdahl (Dept. of Theoretical Phys., Faculty of Sci., Australian Nat. Univ., Canberra, ACT, Australia).

J. Phys. A (GB), vol.16, no.7, p.1441-7 (11 May 1983).

From time to time modifications of Einstein's general theory of relativity have been considered the central feature of which, on a formal level, is the appearance in place of the Einstein Lagrangian R of a more general Lagrangian L. On physical grounds one will require L to differ from R only by terms whose presence has no substantial observational consequences under 'ordinary' conditions. No non-trivial exact vacuum solutions of the equations generated by any such Lagrangian appear to be known, the Schwarzschild metric being regarded as a 'trivial solution' in this context. The author considers pp waves, first as exact solutions of the vacuum equations generated by a family of inhomogeneous quadratic Lagrangians L^*. Thereafter a much wider class of Lagrangians is contemplated, but the greater generality of this is only apparent since all such Lagrangians in effect reduce to L^*. (15 refs.)

64787 . A coordinate-free derivation of a generalized geodesic deviation equation. N.S.Swaminarayan (Dept. of Math., Chelsea Coll., Univ. of London, London, England), J.L.Safko.

J. Math. Phys. (USA), vol.24, no.4, p.883-5 (April 1983).

A simple, coordinate-free exact derivation of the geodesic deviation equation is given. This result includes the possibility of nonvanishing torsion. The authors then show that this form of the geodesic deviation equation can be specialized to various results given previously in the literature. (16 refs.)

64788 The general theory of *R*-separation for Helmholtz equations. E.G.Kalnins (Math. Dept., Univ. of Waikato, Hamilton, New Zealand), W.Miller,Jr..

J. Math. Phys. (USA), vol.24, no.5, p.1047-53 (May 1983).

The authors develop the theory of R-separation for the Helmholtz equation on a pseudo-Riemannian manifold (including the possibility of null coordinates) and show that it, and not ordinary variable separation, is the natural analogy of additive separation for the Hamilton-Jacobi equation. They provide a coordinate-free characterization of variable separation in terms of commuting symmetry operators. (12 refs.)

64789 The multipole structure of stationary space-times. W.Simon, R.Beig (Inst. fur Theoretische Phys., Univ. Wien, Wien, Austria).

J. Math. Phys. (USA), vol.24, no.5, p.1163-71 (May 1983).

A definition of multipole moments for stationary asymptotically flat solutions of Einstein's equations is proposed. It is shown that these moments characterize a given space-time uniquely. Conversely, they can be arbitrarily prescribed, i.e. they generate power series for the field variables which satisfy the field equations to all orders. Despite their apparently rather different origin, they are shown to be identical with the Geroch-Hansen ones. (20 refs.)

64790 Compatibility of rigid motions with the relativistic incompressibility condition. V.Del Olmo, J.Olivert (Dept. de Mecanica y Astron., Facultad de Matematicas, Valencia, Spain).

J. Math. Phys. (USA), vol.24, no.5, p.1172-81 (May 1983).

The compatibility of the hypoelastic-Synge (isotropic case) and hypoelastic-Carter and Quintana (fully isotropic case) almost-thermodynamic material schemes with the relativistic incompressibility condition given by Ferrando and Olivert, is analyzed. The behavior of those schemes in Born-rigid motion is also studied and an additional stipulation is joined to the Born rigidity concept. This requisite leads to the vanishing of the relativistic stress tensor spatial variation and, in hypoelastic-Carter and Quintana and hypoelastic-Maugin almost-thermodynamic material schemes, leads to the absence of mechanical power originated by internal rotation. The rigidity definition that is proposed remains valid for more general almost-thermodynamic material schemes, as far as the compatibility with the incompressibility condition quoted above is concerned. (15 refs.)

64791 Rotating hollow cylinders: general solution and Machian effects. F.Embacher (Inst. fur Theoretische Phys., Univ. Wien, Wien, Austria).

J. Math. Phys. (USA), vol.24, no.5, p.1182-6 (May 1983).

The general solution of the exact gravitational field of a rotating hollow cylinder is derived. It is more general than the solution found by E. Frehland (1972). Machian effects are considered. (15 refs.)

64792 A simplified derivation of the Geroch group in two-dimensional reduced gravity. Yong-Shi wu (Inst. for Advanced Study, Princeton, NJ, USA), Mo-Lin ge.

J. Math. Phys. (USA), vol.24, no.5, p.1187-92 (May 1983).

By generalizing the authors' previous treatment of hidden symmetry in two-dimensional chiral models, a simple and explicit approach is proposed to the Geroch group for the vacuum Einstein equations with the metric tensor depending only on two variables ('two-dimensional reduced gravity'). An infinite number of infinitesimal transformations for the metric tensor preserving the equations of motion are summarized by an explicit parametric transformation and the commutators among them are calculated in a simple and straightforward way. These transformations and their group structure are further identified to be those of the well-known Geroch group. (12 refs.)

64793 Limiting density of matter as a universal law of nature. M.A.Markov (Inst. of Nuclear Res., Acad. of Sci., USSR).

JETP Lett. (USA), vol.36, no.6, p.265-7 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.214-16 (20 Sept. 1982). [received: April 1983]

It is suggested that the density of matter in nature is always less than or equal to a certain value ρ_q, which is constructed from universal constants: $\rho_q = c^5/\kappa^2\hbar \sim 10^{94}$ g/cm^3. As an example, a modified Einstein equation is derived, which, at a low density of matter, $\rho \ll \rho_q$, turns out to be a canonical Einstein equation without the Λ term. With $\rho = \rho_q$, the equations describe a de Sitter Universe. (5 refs.)

64794 Closed form for Van Stockum interior solution of Einstein's equations. J.N.Islam (Dept. of Math., City Univ., London, England).

Phys. Lett. A (Netherlands), vol.94A, no.9, p.421-3 (4 April 1983).

The author finds a closed form for the Van Stockum interior solution of Einstein's equations representing rigidly rotating dust. The part of the solution which is regular on the rotation axis is expressed in terms of an arbitrary function of one variable. An expression for the solution is obtained near the axis of rotation and an explicit particular solution is presented. It is noted that a similar procedure can be followed for the author's rigidly rotating charged dust solution. (5 refs.)

64795 Non-existence of the Reissner-Nordstrum repulsion in general relativity. O.Gron (Inst. of Phys., Univ. of Oslo, Oslo, Norway).

Phys. Lett. A (Netherlands), vol.94A, no.9, p.424-6 (4 April 1983).

The radial motion of a free neutral test particle in the Reissner-Nordstrom space-time is studied. It is shown that when the contribution of the electrical energy to the mass of the central body is properly taken account of, there is no repulsion of the test particle inside the inner horizon of the space-time. (10 refs.)

64796 Solutions to the general-relativistic Tolman-Wyman equation. P.G.Whitman (Univ. of Southwestern Louisiana, Lafayette, LA, USA).

Phys. Rev. D (USA), vol.27, no.8, p.1722-7 (15 April 1983).

The Tolman-Wyman equation is considered and regular solutions are given. A generalisation procedure is developed whereby known solutions for static metrics can be used as particular integrals of the Tolman-Wyman equation. This leads to new interiors for which the equation of state is not completely independent of that belonging to the original metric. A differential relation connecting the two sets of thermodynamic functions is given. A number of metrics are also presented for which the particular integral is not known a priori. The new interiors discussed here contain the only known nonpathological general solutions to the Tolman-Wyman equation. (9 refs.)

64797 Static plane-symmetric scalar fields with a traceless energy-momentum tensor in general relativity. A.N.Vaidya, M.M.Som (Inst. de Fisica, Univ. Federal do Rio de Janeiro, Rio de Janeiro, Brazil).

Phys. Rev. D (USA), vol.27, no.8, p.1728-30 (15 April 1983).

The problem of zero-mass scalar fields coupled to the gravitational field in the static plane-symmetric case is completely solved for a traceless energy-momentum tensor. (3 refs.)

64798 General static plane-symmetric solutions of the Einstein-Maxwell equations. P.A.Amundsen, O.Gron (Inst. of Phys., Univ. of Oslo, Oslo, Norway).

Phys. Rev. D (USA), vol.27, no.8, p.1731-9 (15 April 1983).

A general form of the metric in a space-time with nonvanishing cosmological constant outside a massive, electrically charged plane of infinite extension is found as a solution of the Einstein-Maxwell field equations. The general solution is new, but it includes several well-known solutions corresponding to special physical cases. Also, the general form of the authors' solution makes it possible easily to identify different metrics corresponding to equivalent space-times. Physical properties of the solution are discussed. The plane-symmetric universe analogous to the spherically symmetric de Sitter Universe is found separately, since it is not included in the general solution. (85 refs.)

64799 Weyl tensor as a conformal mapping criterion. Ya.I.Pugachev (Kubanskii State Univ., USSR).

Sov. Phys. J. (USA), vol.25, no.7, p.666-9 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.92-5 (July 1982). [received: May 1983]

The nonequivalence of the Weyl tensor and the conformal correspondence as conformal mapping criteria for Riemann spaces is established in a previous paper (1977). It is proved rigorously by an example of a space of constant De Sitter curvature that the disappearance of the Weyl tensor is a necessary but not sufficient condition for conformal mapping. (3 refs.)

64800 Linear Einstein equations. III. A.N.Temchin.
Sov. Phys. J. (USA), vol.25, no.7, p.669-80 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.95-8 (July 1982). [received: May 1983]
For pt.II, see Sov. Phys. J. (USA), vol.25, no.4, p.293 (1982) or Izv. VUZ. Fiz. (USSR), vol.25, no.4, p.3 (1982). The Cauchy problem for equations of the theory of gravitation, linearized around the non-Galilean metric $g_{(0)\alpha\beta}$, can have a nonunique solution. (3 refs.)

Remark on the isotropic form of the Schwarzschild interior metric ......See Entry 64622

Positive mass theorems for black holes ......See Entry 64801

The complete field of charged perfect fluid spheres and of other static spherically symmetric charged distributions ......See Entry 64807

Vector mesons in Friedman space-time ......See Entry 64810

Geometrical interpretation of a generalized theory of gravitation ......See Entry 64811

Gravitational anisotropies of gyromagnetic ratios and tests of general relativity ......See Entry 64815

On a class of synchronized observers attached to the Lorentzian structures ......See Entry 65037

Polytropic spheres with isothermal cores ......See Entry 69484

Dyon black hole and its mass formula in the Tomimatsu-Sato-Yamazaki space-time ......See Entry 69490

Relativistic paramagnetism ......See Entry 69491

Relativistic conic sections ......See Entry 69668

General solutions for a cosmological Robertson-Walker metric in the Brans-Dicke theory ......See Entry 69762

04.30 GRAVITATIONAL WAVES AND RADIATION: THEORY

Colliding plane gravitational and electromagnetic waves ......See Entry 64781

Newtonian gravity on the null cone ......See Entry 64808

Stellar collapses in the Galaxy ......See Entry 69632

04.40 CONTINUOUS MEDIA; ELECTROMAGNETIC AND OTHER MIXED GRAVITATIONAL SYSTEMS

64801 Positive mass theorems for black holes. G.W.Gibbons, S.W.Hawking (DAMTP, Univ. of Cambridge, Cambridge, England), G.T.Horowitz, M.J.Perry.
Commun. Math. Phys. (Germany), vol.88, no.3, p.295-308 (March 1983).
The authors extend Witten's (1981) proof of the positive mass theorem at spacelike infinity to show that the mass is positive for initial data on an asymptotically flat spatial hypersurface Σ which is regular outside an apparent horizon H. In addition, they prove that if a black hole has electromagnetic charge, then the mass is greater than the modulus of the charge. These results are also valid for the Bondi mass at null infinity. Finally, in the case of the Einstein equation with a negative cosmological constant, they show that a suitably defined mass is positive for data on an asymptotically anti-de Sitter surface Σ which is regular outside an apparent horizon. (19 refs.)

64802 Hodge theory used to produce finite self-energy models of the electron. E.Ihrig (Dept. of Math., Arizona State Univ., Tempe, AZ, USA).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.329-46 (April 1983).
The relationship between electromagnetic fields and topology is discussed. Hodge theory is generalized to classify static fields in static wormhole models. This generalization is used to show models of the electron exist which have finite self-energy. These models always have $1/R^2$ electric fields and self-energies of $4\pi\, q^2/R_0$, where R_0 is the inner radius of the wormhole. (9 refs.)

64803 Producion of tachyons from Schwarzschild black holes. S.K.Srivastava (Government Coll., Port Blair, India).
J. Math. Phys. (USA), vol.24, no.5, p.1317-20 (May 1983).
Inside the Schwarzschild surface the line element becomes spacelike. Hence, in the present paper, the Schwarzschild black hole is considered as a spherical world of tachyons. It is assumed that tachyons are present in this world in a superdense state. In this framework a spacelike line element for this world is derived. Moreover, the scalar wavefunction of a tachyon is obtained which satisfies the Klein-Gordon equation. Expressions for transmission and reflection coefficients of a scalar tachyon wave from a Schwarzschild surface are obtained. It is found that transmission and reflection coefficients are equal. Expressions for energy and momentum of a tachyon, emitted from a Schwarzschild black hole, are also obtained. (7 refs.)

64804 Eigenvalues of the Chandrasekhar-Page angular functions. K.G.Suffern (School of Math. & Phys., Macquarie Univ., North Ryde, Australia).
J. Math. Phys. (USA), vol.24, no.5, p.1350-8 (May 1983).
The Chandrasekhar-Page angular functions for the Dirac equation in the Kerr-Newman background are expanded as series of hypergeometric polynomials, and a three-term recurrence relation is derived for the coefficients in these series. This leads to a transcendental equation for the determination of the separation consant which is obtained initially as a power series and is then iterated by the method of Blanch (1946) and Bouwkamp (1947). (14 refs.)

64805 The interior metric of a charged perfect fluid sphere. Zhu Shichang (Dept. of Phys., Shanghai Teachers Coll., Shanghai, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1167-72 (Nov. 1982). [received: April 1983]
Discusses the interior solution of the Einstein-Maxwell equations for stable static sphere of charged perfect fluid. (7 refs.)

64806 Is there a quantum equivalence principle?. P.Candelas (Centre for Theoretical Phys., Univ. of Texas, Austin, TX, USA), D.W.Sciama.
Phys. Rev. D (USA), vol.27, no.8, p.1715-21 (15 April 1983).
The understanding that has been gained of accelerated vacua sheds new light on the classic issue of the self-force suffered by a uniformly accelerated charge. Moreover, the fact that, as a result of quantum theory, the radiative decay of an excited atom can be viewed equivalently as the result of the vacuum fluctuations of the electromagnetic field or as the result of the radiative self-force of the electron is shown to be nontrivially linked with the equivalence principle. (10 refs.)

Black holes and the stability of gravitation ......See Entry 64766

Scalar-tensor theory of gravitation: generalizations and experimental limitations ......See Entry 64771

Conformal flat interior solutions for a charged sphere ......See Entry 64772

Space-time in ordered electromagnetic radiation outside a massive plane ......See Entry 64775

An inequality relating mass and electric charge in general relativity ......See Entry 64780

Colliding plane gravitational and electromagnetic waves ......See Entry 64781

Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2) ......See Entry 64783

On the relativistic dynamics of spinning matter in space-time with curvature and torsion ......See Entry 64784

General static plane-symmetric solutions of the Einstein-Maxwell equations ......See Entry 64798

The complete field of charged perfect fluid spheres and of other static spherically symmetric charged distributions ......See Entry 64807

Newtonian gravity on the null cone ......See Entry 64808

Dyon black hole and its mass formula in the Tomimatsu-Sato-Yamazaki space-time ......See Entry 69490

Relativistic paramagnetism ......See Entry 69491

Extreme relativistic model for neutron stars and pulsars ......See Entry 69641

A mathematical solution of general relativistic binary systems ......See Entry 69648

04.50 UNIFIED FIELD THEORIES AND OTHER THEORIES OF GRAVITATION

64807 The complete field of charged perfect fluid spheres and of other static spherically symmetric charged distributions. P.S.Florides (Trinity Coll., Univ. of Dublin, Dublin, Ireland).
J. Phys. A (GB), vol.16, no.7, p.1419-33 (11 May 1983).
Exact solutions are presented which describe the complete field (in the interior and exterior) of the following static spherically symmetric systems: (I) charged perfect fluid spheres and (II) charged distributions with no radial stress. Perfect fluidity in systems (I) and radial stress in systems (II) are defined in two distinct ways and exact solutions are obtained in each case. All the solutions are well behaved everywhere and satisfy the necessary boundary conditions across the surface of the distribution as well as the elementary flatness conditions at the centre of the distribution. Outside the distribution, the solutions are identical to the (exterior) Nordstrom solution. Inside the distribution the solutions for systems (I) reduce to the interior Schwarzschild solution on setting the charge density equal to zero. The solutions for systems (II) reduce, on setting the charge density to zero, to the 'new interior Schwarzschild solution' obtained by the author (1974). It is suggested that the solutions for systems (II) may represent the field inside a charged Einstein cluster. (7 refs.)

64808 Newtonian gravity on the null cone. J.Winicour (Dept. of Phys. & Astron., Univ. of Pittsburgh, Pittsburgh, PA, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1193-8 (May 1983).
For a general relativistic ideal fluid, the author analyzes the Newtonian limit of the initial value problem set on a family of null cones. The underlying Newtonian structure is described using Cartan's elegant space-time version of Newtonian theory and a limiting process rigorously based upon the velocity of light approaching infinity. The author finds that the existence of a Newtonian limit imposes a strikingly simple relationship between the gravitational null data (i.e. the shear of the null cones) and the Newtonian gravitational potential. This result has immediate application to numerical evolution programs for calculating gravitational radiation and might serve as the basis for a post-Newtonian approximation scheme. (28 refs.)

64809 A non-Machian solution in Brans-Dicke theory. S.K.Chakraborty (Phys. Dept., Presidency Coll., Calcutta, India).
J. Math. Phys. (USA), vol.24, no.5, p.1359-60 (May 1983).
A solution of the vacuum field equations of the Brans-Dicke theory of gravitation admitting a particular group of motions is found out. The solution is of interest because it is supposed to be at variance with Machian ideas of inertia. (4 refs.)

Conformal flat interior solutions for a charged sphere ......See Entry 64772

Space-time in ordered electromagnetic radiation outside a massive plane ......See Entry 64775

Geometrical mass of charged particle in Brans-Dicke theory ..See Entry 64776

Colliding plane gravitational and electromagnetic waves ......See Entry 64781

Static plane-symmetric scalar fields with a traceless energy-momentum tensor in general relativity ......See Entry 64797

General static plane-symmetric solutions of the Einstein-Maxwell equations ......See Entry 64798

Linear Einstein equations. III ......See Entry 64800

The interior metric of a charged perfect fluid sphere ......See Entry 64805

Non-abelian conformal gravity as the origin of strong interactions ......See Entry 65082

General vacuum-Universe solutions in Brans-Dicke cosmology ......See Entry 69755

General solutions for a cosmological Robertson-Walker metric in the Brans-Dicke theory ......See Entry 69762

The early Universe and high-energy physics ......See Entry 69770

Stability and structure of Newtonian gravitars ......See Entry 69772

04.60 QUANTUM THEORY OF GRAVITATION

64810 Vector mesons in Friedman space-time. A.A.Grib, A.V.Nesteruk (Dept. of Theoretical Phys., Leningrad Inst. of Precise Mech. & Optics, Leningrad, USSR).
Gen. Relativ. & Gravitation (USA), vol.15, no.1, p.31-45 (Jan. 1983).
Particle creation of vector mesons in a nonstationary Friedman space-time is investigated by the method of diagonalizing the instantaneous Hamiltonian. The density of particles and the full stress-energy tensor are calculated. Reasons are given for the Higgs treatment of vector mesons in a gravitational field creating pairs of particles. (17 refs.)

64811 Geometrical interpretation of a generalized theory of gravitation. G.Kunstatter, J.W.Moffat (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada), J.Malzan.
J. Math. Phys. (USA), vol.24, no.4, p.886-9 (April 1983).
The geometrical structure is developed for a theory of gravitation, based on a nonsymmetric metric in a four-dimensional real manifold. The local fiber

bundle gauge group is GL(4,*R*), which contains the (local) homogeneous Lorentz gauge group SO(3,1) of general relativity. (8 refs.)

64812 The gauge treatment of gravity. D.Ivanenko, G.Sardanashvily (Dept. of Phys., State Univ. of Moscow, Moscow, USSR).
Phys. Rep. (Netherlands), vol.94, no.1, p.1-45 (Jan. 1983).
The gauge gravitation theory, in spite of twenty five years of its history, still remains the single gap in the excellent gauge picture of fundamental interactions. The main disputable point is the gauge status of Einstein's gravitational field, which is a metric or tetrad field, while gauge fields represent connections on fiber bundles. The corner-stones of Einstein's gravitation theory are the relativity and equivalence principles. Having been reformulated in the fiber bundle terms, the gravitation theory turns out to be built from these principles directly as a gauge theory of space-time symmetries, which, however, are spontaneously broken down to the Lorentz symmetries. Metric gravitational fields appear in such a theory as the consequence of this spontaneous symmetry breaking and have the nature of Goldstone type fields. The Lorentz, GL(4,*R*) and Poincare gauge theories of gravitation are analyzed from these points of view, and some outlooks of the gauge treatment of gravitation, e.g. as the affine-metric theory, are discussed. (118 refs.)

Scalar-tensor theory of gravitation: generalizations and experimental limitations ....See Entry 64771

Classical and quantum models of strong cosmic censorship .....See Entry 64774

Local symmetries in extended conformal gravity and conformal supergravity in superspace ....See Entry 64814

Non-abelian conformal gravity as the origin of strong interactions ....See Entry 65082

Robertson-Walker cosmologies with a trace anomaly effect in their dynamical description ....See Entry 69756

04.65 SUPERGRAVITY

64813 Gauging of d=11 supergravity?. L.Castellani, P.Fre, F.Giani, K.Pilch, P.van Nieuwenhuizen (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Ann. Phys. (USA), vol.146, no.1, p.35-77 (March 1983).
The role of antisymmetric tensor fields in the gauging of groups is released to theorems on cohomology theory, and Cartan integrable systems are discussed. Examples are given. Various possibilities to gauge $d=11$ supergravity by decontracting its underlying group are considered. In particular the simple supergroups *Osp* (1/64) and *SU*(32/1) yield a negative result, but a certain nonsemisimple supergroup containing *Osp*(1/32) is proposed as a viable candidate. The corresponding action would no longer contain the 3-index photon $A_{\mu\nu\rho}$, but instead a second spin $^3/_2$ field η_μ and boson fields B_μ^{a1a2} and $B_\mu^{a1...a5}$. A first order formalism for $d=11$ is presented. It is to be used for an improved form of dimensional reduction. (25 refs.)

64814 Local symmetries in extended conformal gravity and conformal supergravity in superspace. F.Mansouri (Dept. of Phys., Univ. of Cincinnati, Cincinnati, OH, USA).
J. Math. Phys. (USA), vol.24, no.4, p.890-6 (April 1983).
The extended conformal field theory of gravity is discussed, and its local symmetries are compared to those of Einstein and standard Weyl theories. It is then shown that the local symmetries of the extended conformal geometry are also natural for the construction of SU(*N*)-extended conformal supergravity theories in superspace. The natural superspace for the formulation of such theories is one with two sets of four-component fermionic variables which transform oppositely under scale transformations. (14 refs.)

04.80 EXPERIMENTAL TESTS OF GENERAL RELATIVITY AND OBSERVATIONS OF GRAVITATIONAL RADIATION

64815 Gravitational anisotropies of gyromagnetic ratios and tests of general relativity. J.C.Gallop, B.W.Petley (NPL, London, England).
Nature (GB), vol.303, no.5912, p.53-4 (5 May 1983).
It is a direct consequence of the Einstein equivalence principle (EEP) that all atomic clocks will run at the same rate if situated at the same point in space-time. This prediction of a universal gravitational redshift is a property of any self-consistent metric theory of gravity. The class of experiments considered essentially involves a comparison of two clocks, one of which is a quartz crystal stabilized to a caesium-beam atomic frequency standard, and the other, more important for this discussion, is a NMR clock, for which the 'ticks' are provided by the free precession of a sample of polarized nuclear spins in a stable and uniform magnetic field. Two experimental null results have been reported, one by Hughes (1960) and the other by Drever (1961). The authors point out that some measurements already exist for spin 1/2 systems which can put tighter limits on anisotropic precession frequencies than the Hughes-Drever results, and suggest an experimental technique that should allow a further improvement in precision by up to six orders of magnitude. (22 refs.)

64816 Test of the principle of equivalence by a null gravitational red-shift experiment. J.P.Turneaure (Dept. of Phys., Stanford Univ., Stanford, CA, USA), C.M.Will, B.F.Farrell, E.M.Mattison, R.F.C.Vessot.
Phys. Rev. D (USA), vol.27, no.8, p.1705-14 (15 April 1983).
A test of the Einstein equivalence principle (EEP) was performed by carrying out a 'null' gravitational red-shift experiment. The experiment compared the rates of a pair of hydrogen maser clocks with those of a set of three superconducting-cavity stabilised oscillator clocks as a function of the solar gravitational potential. If EEP were not valid, the relative rates could vary with potential. During the experiment, the solar potential in the laboratory varied approximately linearly at 3 parts in 10^{12} per day because of the Earth's orbital motion, and diurnally with an amplitude of 3 parts in 10^{13} because of the Earth's rotation. An upper limit on the relative frequency variation of 1.7 parts in 10^2 of the external potential was set. The accuracy was limited by the frequency stability of the clocks and by unmodelled environmental effects. The result is consistent with the EEP at the two percent level. The experiment can also be viewed as setting a limit on a possible spatial variation of the fine-structure constant. (17 refs.)

Electronic Cavendish device ....See Entry 64623

Gravitational lenses ....See Entry 69487

05.00 STATISTICAL PHYSICS AND THERMODYNAMICS

(see also 02.50 Probability theory, stochastic processes, and statistics)

05.20 STATISTICAL MECHANICS

64817 Upper bounds for density matrices using path integrals. E.P.Gross (Dept. of Phys., Brandeis Univ., Waltham, MA, USA).
J. Stat. Phys. (USA), vol.30, no.1, p.45-66 (Jan. 1983).
Discusses upper bounds for density matrices for a particle, that occur in potential theory, and as a result of averaging over other degrees of freedom. The Weiner path integral representation is used. A basic technique of Symanzik (1965) is generalized in a variety of ways to a series of sharper upper bounds. There are distinct ways of applying the technique to the two-parameter integrals that describe averaged density matrices. A single-parameter application of the Symanzik technique leads to a temperature-dependent potential problem. The nature of the bounds is illustrated for two-parameter integrals by studying a soluble quadratic action, a one-dimensional delta correlation function action and shell correlation functions. The dependence on dimension is studied in the latter case. (12 refs.)

64818 Convergence to stationary states for infinite harmonic systems. C.Boldrighini, A.Pellegrinotti (Inst. Matematico, Univ. di Camerino, Camerino, Italy), L.Triolo.
J. Stat. Phys. (USA), vol.30, no.1, p.123-55 (Jan. 1983).
The authors study the evolution of the states for one-dimensional infinite harmonic systems, interacting through a translation invariant force of rapid decrease. They prove that for a large class of initial states convergence to a Gaussian limiting state, as time goes to infinity, is equivalent to convergence of the covariance. The main assumption on the initial states is a kind of weak dependence between distant regions (mixing condition). They prove also convergence of the covariance under some general assumptions. They show furthermore that there are two countable families of intensive constants of the motion, which are 'inherited' from the corresponding finite systems. The translation invariant limiting states are in one-to-one correspondence with the admissible values of these constants of the motion. Moreover, under some additional regularity assumption, such states are shown to be Gibbs states obtained by a 'Boltzmann-Gibbs' prescription. (19 refs.)

Preliminaries to the ergodic theory of infinite-dimensional systems: a model of radiant cavity ....See Entry 64831

Approach to field-induced stationary state in a gas of hard rods ....See Entry 64862

A molecular theory for the freezing of hard spheres ....See Entry 67165

Theory of thermophoresis of moderately large aerosol particles ....See Entry 68813

05.30 QUANTUM STATISTICAL MECHANICS

(see also 67. Quantum fluids, and 71. Electron states in condensed matter)

64819 Quantum virial coefficients as cumulants of imaginary time-ordered Mayer diagrams. A.Royer (Centre de Recherche de Math. Appl., Univ. de Montreal, Montreal, Quebec, Canada).
J. Math. Phys. (USA), vol.24, no.4, p.897-912 (April 1983).
The virial coefficients for a quantum gas (including quantum statistics) are expressed as sums of cumulants of connected (generalized) Mayer diagrams, the cumulants being built on the irreducible blocks of the diagrams. The Mayer diagrams are defined for the quantum case in terms of imaginary time-ordered exponentials, the quantum statistics being incorporated in the guise of multiparticle interactions. In order to extend Mayer diagrams to multiparticle interactions the author utilizes terminology and methods from the theory of hypergraphs. The virial coefficients naturally separate into a quantum Boltzmann gas contribution, an ideal quantum gas contribution, and a final term expressing correlations between dynamics and statistics. In the classical limit, connected Mayer diagrams factorize into their irreducible blocks; the cumulants over irreducible blocks then vanish (by a basic property of cumulants), except for diagrams which are themselves irreducible, whence the classical result of Mayer (extended to multiparticle interactions). In the quantum case, the imaginary time ordering prevents the factorization into irreducible blocks by time entangling them. As a further illustration of the use of hypergraph-cumulant methods, the author directly deduces the expressions of the virial coefficients in terms of Ursell-Kahn-Uhlenbeck cluster functions (the ideal quantum gas contribution naturally appears in that form). (31 refs.)

64820 Formal state determination. I.D.Ivanovic (Dept. of Phys. & Meteorology, Faculty of Sciences, Belgrade, Yugoslavia).
J. Math. Phys. (USA), vol.24, no.5, p.1199-205 (May 1983).
Following the general results of Park and Band (1971) it is shown that any state of a quantal ensemble allowed by the Hilbert space formulation of nonrelativistic quantum mechanics may be determined from the results of measurements, under the assumption that all measurements, those of energy, position, and spin projection, are in accordance with the projection postulate. (18 refs.)

64821 Particle statistics in three dimensions. R.Sorkin (Inst. for Advanced Study, Princeton, NJ, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1787-97 (15 April 1983).
A generalised framework for particle statistics is developed within which it becomes clear how bosons can combine to form fermions without violating the normal connection between spin and statistics. In the situation where internal and external particle degrees of freedom are separable, the possible statistical types are found and their combining rules derived. Here the statistical 'interaction' between two particles is characterised either by the familiar sign or by an integer ('twist number'). However, further possibilities arise if the separability of external from internal degrees of freedom fails, as it can in gauge theories. In spatial dimensions other than three the 'fermion from boson' phenomenon does not occur. (16 refs.)

64822 Reexamination of the third-order renormalisation-group calculation for a one-dimensional interacting Fermi system. Chin-sen Ting, Xian-xi Dai, Bambi Hu (Dept. of Phys., Univ. of Houston, Houston, TX, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4384-93 (1 April 1983).
A one-dimensional interacting Fermi system with weak-coupling parameters g_1 (<0) and g_2 is reexamined in the third-order renormalisation-group approach. The authors' result indicates that the value of the invariant coupling g'_1 varies, depending on whether the limit $\omega \rightarrow 0$, $q=0$ or $\omega=0$, $q \rightarrow 0$ is

taken. For $\omega \rightarrow 0$, $q=0$, the invariant coupling g'_1 scales to $g'_1/\pi v \simeq -1.24$, and for $\omega=0$, $q \rightarrow 0$, it scales to $g'_1/\pi v \simeq -0.716$. They also argue that the invariant coupling g'_1 obtained from neither limit is appropriate for calculating the critical exponents of various response functions. (23 refs.)

Parastatistics and the equation of state for the early Universe ....See Entry 69757

05.40 FLUCTUATION PHENOMENA, RANDOM PROCESSES, AND BROWNIAN MOTION

64823 **Subharmonic stroboscopic sampling method for study of period-doubling bifurcation and chaotic phenomena in forced nonlinear oscillators.** Hao Bai-Lin (Inst. of Theoretical Phys., Acad. Sinica, Peking, China), Zhang Shu-Yu.
Acta Phys. Sin. (China), vol.32, no.2, p.198-208 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
By using subharmonic stroboscopic sampling method, very high resolution, comparable with that for discrete mappings, has been reached in numerical study of periodically forced nonlinear oscillators. For the first time period-doubling bifurcation sequences up to 8192th subharmonics and corresponding sequences of chaotic bands are identified for a system, described by ordinary differential equations. Secondary and tertiary bifurcation sequences embedded in chaotic bands are shown to exist. Merits and limitations of this method as well as some precaution in using it are discussed briefly. (26 refs.)

64824 **A local time approach to the self-intersections of Brownian paths in space.** J.Rosen (Dept. of Math. & Statistics, Univ. of Massachusetts, Amherst, MA, USA).
Commun. Math. Phys. (Germany), vol.88, no.3, p.327-38 (March 1983).
The author studies the Brownian functional $\alpha(x,B)=\int_B\int\delta_x(W_t\text{-}W_s)dsdt$, where W_t is a Brownian path in two or three dimensions. For B off the diagonal, $\alpha(x,B)$ is identified with a local time, and the Holder continuity of $\alpha l(x,B)$ in both x and B is established. (20 refs.)

64825 **Brownian motion, the second law and Boltzmann.** T.W.Marshall.
Eur. J. Phys. (GB), vol.3, no.4, p.215-22 (1982).
The relative merits of 'Boltzmann entropy' and 'Gibbs entropy' are discussed. It is found that, for describing the irreversible features of Brownian motion the 'Gibbs entropy' is the superior concept. In terms of this the Brownian motion gives an excellent illustration of the second law of thermodynamics. The historical origins of the 'Gibbs entropy' are examined, and it is concluded that Ludwig Boltzmann must be given a substantial part of the credit for it. On the other hand, the equation $S=k \log W$, which has been attributed posthumously to Boltzmann, does less than full justice to his concept of entropy, and has led to serious misunderstandings in the theory of Brownian motion. (29 refs.)

64826 **Jumping particle model. Period doubling cascade in an experimental system.** P.Pieranski (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
J. Phys. (France), vol.44, no.5, p.573-8 (May 1983).
An experimental model of a modification of the Fermi acceleration problem is described. Evidence is presented for three consecutive bifurcations on the period doubling route of the system from regular to chaotic behaviour. (14 refs.)

64827 **Large coupling behaviour of the Lyapunov exponent for tight binding one-dimensional random systems.** J.Avron, W.Craig, B.Simon (Div. of Phys., Math. & Astron., California Inst. of Technol., Pasadena, CA, USA).
J. Phys. A (GB), vol.16, no.7, p.L209-11 (11 May 1983).
Studies the Lyapunov exponent $\gamma_\lambda(E)$ of $(hu)(n)=u(n+1)+u(n-1)+\lambda V(n)u(n)$ in the limit as $\lambda \rightarrow \infty$ where V is a suitable random potential. The authors prove that $\gamma_\lambda(E) \sim \ln\lambda$ as $\lambda \rightarrow \infty$ uniformly as E/λ runs through compact sets. They also describe a formal expansion (to order λ^{-2}) for random and almost periodic potentials. (9 refs.)

64828 **Self-diffusion for particles with stochastic collisions in one dimension.** C.Kipnis (Courant Inst. for Math. Sci., New York, NY, USA), J.L.Lebowtiz, E.Presutti, H.Spohn.
J. Stat. Phys. (USA), vol.30, no.1, p.107-21 (Jan. 1983).
Color diffusion in a classical fluid composed of two species differing only by color is intimately connected with the asymptotic behavior of trajectories of test particles in the equilibrium system. The authors investigate here such behaviour in a one-dimensional system of 'hard' points with density ρ and velocities ± 1. Colliding particles reflect each other with probability p and pass through each other with probability $1-p$. They show that for $p>0$ the appropriately scaled trajectories of n particles converge to $\rho^{-1}b(t)+(1-p)(\rho p)^{-1}b_j(t)$, $j=1, \ldots, n$. The $b(t)$, $b_j(t)$ are standard, independent Brownian motions. The common presence of $b(t)$ means that motions are not independent and hence that the macroscopic state of the colored system is not in local equilibrium with respect to color. (11 refs.)

64829 **The escape time in nonpotential systems.** C.W.Gardiner (Phys. Dept., Univ. of Waikato, Hamilton, New Zealand).
J. Stat. Phys. (USA), vol.30, no.1, p.157-77 (Jan. 1983).
A generalisation of Kramer's method (1940) is developed for computing the escape time in nonpotential systems. The method is applied to i) moderate friction case in the Kramers problem; ii) a certain two dimensional system treated by Caroli et al. (1982) using a perturbative method. (18 refs.)

64830 **On the dynamics of excitations in disordered systems.** S.Mukamel (Dept. of Chem., Univ. of Rochester, Rochester, NY, USA).
J. Stat. Phys. (USA), vol.30, no.1, p.179-84 (Jan. 1983).
A new, time-local (TL) reduced equation of motion for the probability distribution of excitations in a disordered system is developed. To $O(k^2)$ the TL equation results in a Gaussian spatial probability distribution, i.e. $\langle P(\mathbf{r},t)\rangle=[(2\pi\xi)^{1/2}]^{-d}\exp(-r^2/2\xi^2)$, where $\xi=\xi(t)$ is a correlation length, and $r=|\mathbf{r}|$. The corresponding distribution derived from the Hahn-Zwanzig (HZ) equation is more complicated and assumes the asympotic ($r \rightarrow \infty$) form: $\langle P(\mathbf{r},s)\rangle \sim (s\xi^d)^{-1}\exp(-r/\xi).(r/\xi)^{(1-d)/2}$ where $\xi=\xi(s)$, d is the space dimensionality, and s is the Laplace transform variable conjugate to t. The HZ distribution generalizes the scaling form suggested by Alexander et al. (1981) for $d=1$. In the Markov limit $\xi(t) \sim \sqrt{t}$, $\xi(s) \sim 1/\sqrt{s}$, and the two distributions are identical (ordinary diffusion). (11 refs.)

64831 **Preliminaries to the ergodic theory of infinite-dimensional systems: a model of radiant cavity.** G.Casati (Istituto di Fisica, Univ. di Milano, Milano, Italy), I.Guarneri, F.Valz-Gris.
J. Stat. Phys. (USA), vol.30, no.1, p.195-217 (Jan. 1983).
The authors discuss a number of mathematical results that are relevant to the statistical mechanics of a model of radiant cavity in which the electromagnetic field interacts with a nonlinear charged oscillator. In particular, they show that energy equipartition in the sense of Jeans (1916) would exclude local exponential instability of orbits; it would also prevent the existence of significant finite invariant measures on a given energy surface. A phase space of infinite total energy is defined, and an invariant measure in it is built, for which different modes of the field are statistically independent. (13 refs.)

64832 **Markov processes as a tool in field theory.** E.B.Dynkin (Dept. of Math., Cornell Univ., Ithaca, NY, USA).
J. Funct. Anal. (USA), vol.50, no.2, p.167-87 (1 Feb. 1983).
Brydges, Frohlich, and Spencer (Commun. Math. Phys., vol.83, p.123-50, 1982) have successfully applied Markov chains to classical spin systems. Using probabilistic methods in a more systematic way, this paper improves some of their results. The methods can be extended to fields with continuous parameter such as $P(\phi)$ fields. (7 refs.)

64833 **Equilibrium potential of killed Markov process.** Li Zhichan (Hebei Univ., Baoding, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.12, p.1255-8 (Dec. 1982).
The equilibrium problem of the Green potentials for Brownian motion has attracted general attention. The author investigates the equilibrium potential of the killed Markov process, following the work by Blumenthal and Getoor (1968) on its equilibrium measure. (5 refs.)

64834 **Fokker-Planck description of multi-degree-of-freedom systems with correlated fluctuations.** B.J.West (Center for Studies of Nonlinear Dynamics, La Jolla Inst., La Jolla, CA, USA), K.Lindenberg.
Phys. Lett. A (Netherlands), vol.95A, no.1, p.44-6 (11 April 1983).
A Fokker-Planck equation is derived for a many-degree-of-freedom nonlinear Langevin equation driven by parametric gaussian fluctuations with finite correlation times. An oscillator with a fluctuating frequency is presented as an example. (22 refs.)

64835 **Random walk in a random environment and $1/f$ noise.** E.Marinari (Service de Phys. Theorique, CENS, Gif-sur-Yvette, France), G.Parisi, D.Ruelle, P.Windey.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1223-5 (25 April 1983).
A simple model showing a $1/f$ behavior is proposed. It is argued, on the basis of a scaling argument, that is has $(1nf)^k$ corrections. Numerical simulations confirm this picture. (5 refs.)

64836 **Comment on 'hopping mechanism generating $1/f$ noise in nonlinear systems'.** M.R.Beasley (Dept. of Appl. Phys., Stanford Univ., Stanford, CA, USA), D.D'Humieres, B.A.Huberman, R.F.Vos, F.T.Arecchi, F.Lisi.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1328-30 (25 April 1983).
In a letter Arecchi and Lisi (1982) claim to have observed $1/f$ noise associated with the chaotic dynamics of a certain driven nonlinear system. In the comment it is pointed out that the essential features of the noise spectra observed by those authors, which are also observed in the case of the forced pendulum, can be understood in terms of a simple model that is in good qualitative agreement with their results but which does not support their contention that such chaotic systems exhibit an intrinsic $1/f$ noise. (11 refs.)

64837 **The approach to the Boltzmann distribution in Brownian motion.** T.W.Marshall (Dept. of Math., Manchester Univ., Manchester, England).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.241-5 (March 1983).
The solution is obtained, in the weak-damping approximation to the problem of the approach to the barometric distribution in Brownian motion. (5 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior ....See Entry 64582

Spectra of electronic noise signals: A microcomputer experiment ....See Entry 64616

Dynamics of nonlinear dissipative oscillators ....See Entry 64618

Model experiment illustrating sedimentation by microcomputer ....See Entry 64628

Stationary probability distribution for nonlinear dynamical systems with noise ....See Entry 64689

Chaos in a perturbed nonlinear Schrodinger equation ....See Entry 64749

Quantisation of dynamical systems and stochastic control theory ....See Entry 64751

Upper bounds for density matrices using path integrals ....See Entry 64817

Potts model formulation of branched polymers in a solvent .....See Entry 64841

On random walks in percolation models ....See Entry 64843

Random resistor networks as a theory of interacting Bose and Fermi fields. I. Effective medium treatment of percolation ....See Entry 64845

Yang-Lee singularity and the mobility edge ....See Entry 64846

Interface energy in random systems ....See Entry 64855

Brownian dynamics simulation of systems with transitions, particularly conformational transitions in chain molecules ....See Entry 66169

Theory of the spectrum of the quantised light field ....See Entry 66248

The effect of Brownian motion on the transport properties of a suspension of spherical particles ....See Entry 66619

Diffusion-limited reaction rate theory for two-dimensional systems ....See Entry 68755

Computer simulation of a model for irreversible gelation ....See Entry 68809

05.50 LATTICE THEORY AND STATISTICS; ISING PROBLEMS

(see also 75.10H Ising models)

64838 **Higher-order calculations in the real space dynamic renormalization group: one dimension.** J.Luscombe, G.F.Mazenko (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
Ann. Phys. (USA), vol.146, no.1, p.174-208 (March 1983).
The application of real space dynamic renormalization group methods to the one-dimensional kinetic Ising model is extended to one order higher in perturbation theory. It is shown that the treatment of short-range, local quantities is improved in going to higher order in the perturbation expansion, while that of the long-range properties remains largely unaffected. Arbitrariness in the real space mapping function and how it may be exploited to our advantage is discussed. It is shown that the renormalized Hamiltonian continues to be characterized by one coupling through second order. The authors find that the single spin-flip kinetic Ising model generates at second-order new spin-flip mechanisms in the renormalized dynamical operator but that their effects are small (at most 2%) over the entire temperature range. (24 refs.)

64839 **Note on the 'susceptibility' exponent for two-dimensional percolation.** V.Privman (Baker Lab., Cornell Univ., Ithaca, NY, USA), I.D.Vagner.
Z. Phys. B (Germany), vol.50, no.4, p.353-5 (1983).
New percolation series derived by Duarte and Ruskin (see ibid., vol.46, p.225, 1982) are analysed with a recently developed method of series analysis which explicitly accounts for the leading nonanalytic confluent term. The authors' study provides additional support to the conclusion that systematic deviations

of γ values from the conjectured $\gamma=43/18$ are removed. Estimates of the exponent Δ_1 of the leading nonanalytic confluent term are obtained and compared with previous results. (17 refs.)

64840 Expansions and phase transitions for the ground state of quantum Ising lattice systems. J.R.Kirkwood, L.E.Thomas (Dept. of Math., Univ. of Virginia, Charlottesville, VA, USA).
Commun. Math. Phys. (Germany), vol.88, no.4, p.569-80 (1983).
Expansions for the ground state of some transverse Ising-like models are developed. These expansions are easily estimated by the solutions to some simple implicit equations. Short range or long range order obtains, depending on the coupling constants of the models. (9 refs.)

64841 Potts model formulation of branched polymers in a solvent. A.Coniglio (Dept. of Phys., Boston Univ., Boston, MA, USA).
J. Phys. A (GB), vol.16, no.6, p.L187-91 (21 April 1983).
A Potts model formulation of the statistics of branched polymers or lattice animals in a solvent is given. The Migdal-Kadanoff renormalisation group is employed to study the critical behaviour or fractal dimension of the branched polymer. Four different critical behaviours are found, corresponding to random animal, collapse or θ point, percolation and compact cluster. The θ point behaviour is described by a tricritical point while percolation corresponds to a higher-order critical point, where the effect of the solvent on the branched polymer is the same as the screening effect of the other clusters in percolation. (24 refs.)

64842 On the location of the critical point of the *q*-state Potts model on the hypercubic lattice. D.Hajdukovic (Dept. of Phys. & Meteorology, Faculty of Natural & Math. Sci., Belgrade, Yugoslavia).
J. Phys. A (GB), vol.16, no.6, p.L193-8 (21 April 1983).
The critical temperature of the q-state ferromagnetic Potts model on a hypercubic lattice in d dimensions is expressed as an explicit function of both d and q. The author's formula agrees very well with the existing accurate results and numerous numerical studies for particular values of d and q, and it seems to be an excellent approximation for all d and q. (17 refs.)

64843 On random walks in percolation models. T.Vicsek (Res. Inst. for Tech. Phys., Budapest, Hungary).
J. Phys. A (GB), vol.16, no.6, p.1215-20 (21 April 1983).
Random walks on percolation clusters of any dimension consisting of both directed and undirected bonds are studied. Results conjectured to be exact and supported by Monte Carlo simulation are deduced for the critical parameters of the problem. It is shown that in the undirected case of the model the probabilities of finding the particle in the sites of a finite cluster have a uniform limit distribution. (23 refs.)

64844 Exact results for 2D directed animals on a strip of finite width. V.Hakim (Lab. de Phys. Theorique et Hautes Energies, Univ. Paris-Sud, Orsay, France), J.P.Nadal.
J. Phys. A (GB), vol.16, no.7, p.L213-18 (11 May 1983).
Proves a conjecture giving the exact number of directed animals of s sites with any root, on a strip of finite width of a square lattice. The authors also rederive more simply some previous results concerning the connective constant and particular eigenvectors of the transfer matrix. (11 refs.)

64845 Random resistor networks as a theory of interacting Bose and Fermi fields. I. Effective medium treatment of percolation. J.P.Carton (Service de Phys. du Solide et de Resonance Magnetique, CENS, Gif-sur-Yvette, France).
J. Phys. A (GB), vol.16, no.7, p.L219-23 (11 May 1983).
The problem of random resistor networks is formulated with the help of functional integrals over commuting and anticommuting variables and leads to interacting Bose and Fermi fields. The effective medium approximation is derived following a variational principle. (7 refs.)

64846 Yang-Lee singularity and the mobility edge. A.Kapitulnik (Dept. of Phys. & Astron., Tel Aviv Univ., Ramat Aviv, Tel Aviv, Israel), Y.Shapir.
J. Phys. A (GB), vol.16, no.7, p.L243-8 (11 May 1983).
Gives an exact mapping of the problem of an electron in a one-dimensional random potential onto a Yang-Lee model with random imaginary fields and random bonds. The resistance and inverse localisation length are given respectively by the partition function and the free energy of the spin model. The allowed states and the singular point of their density at the band edge are mapped onto the zeros of the partition function and the Yang-Lee edge. Similar relations are found on a Bethe lattice near the critical point for the pure models. Extending naively to the random case, these relations reproduce the field theory of Harris and Lubensky (1981) with the expansion below eight dimensions. In the presence of randomness, however, the two models differ for any dimension greater than one due to the interactive character of the spin model. This causes its density of states to vanish at the edge in contrast to the $\beta=0$ of the non-interacting electronic model. (34 refs.)

64847 The Oguchi approximation is exact for infinite-dimensional lattices. P.A.Pearce (Dept. of Theoretical Phys., Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
J. Phys. A (GB), vol.16, no.7, p.1475-81 (11 May 1983).
Spin systems are considered on sequences of lattices of increasing dimensionality. By dividing the lattices into suitable clusters with fixed internal interactions and scaling the external spin interactions inversely with the lattice dimension d, it is shown that the Oguchi effective field approximation becomes exact in the limit $d\rightarrow\infty$. (10 refs.)

64848 On a relation between percolation and phase transition in the gauge invariant Ising model. R.Marra (Istituto di Fisica, Univ. di Salerno, Salerno, Italy).
J. Math. Phys. (USA), vol.24, no.4, p.913-16 (April 1983).
The author points out a connection between the coexistence of phases in the Z_2 lattice gauge model and the existence of infinite clusters for a suitable associated system of duplicate currents. (11 refs.)

64849 On the relations between irreducible representations of the hyperoctahedral group and O(4) and SO(4). M.Baake, B.Gemunden, R.Oedingen (Phys. Inst., Univ. Bonn, Bonn, Germany).
J. Math. Phys. (USA), vol.24, no.5, p.1021-4 (May 1983).
The authors describe the relations between the irreducible representations of the hyperoctahedral group in four dimensions and irreducible, low-dimensional representations of the orthogonal groups O(4) and SO(4). (4 refs.)

64850 Kinematics of nucleation in a lattice gas model: microscopic theory and simulation compared. O.Penrose, A.Buhagiar (Faculty of Math., Open Univ., Milton Keynes, England).
J. Stat. Phys. (USA), vol.30, no.1, p.219-41 (Jan. 1983).
A method is described for calculating from first principles the coefficients in the Becker-Doring equations (1935) for the rate of change of the distribution of cluster sizes in a low-density lattice gas with Kawasaki dynamics (1966). The method depends on solving a diffusion problem for the concentration of particles near a given cluster. The coefficients are calculated for cluster sizes up to 6, on a simple cubic lattice at a temperature 0.59 times the critical temperatures, and extrapolated to larger sizes. The resulting version of the Becker-Doring equations is then solved numerically. Comparison with the results of a computer simulation (at overall concentration 0.075) carried out by Kalos and others (1978) indicates that the method gives quite good predictions of the dependence of the cluster distribution on the critical cluster size (usually denoted by l^*) but that the predicted rate of change of critical cluster size with time is too small, at this overall concentration, by a factor of about 0.3. (15 refs.)

64851 Study of the Kosterlitz-Thouless transition by the Mayer expansion. K.R.Ito (Dept. of Math., Bedford Coll., Univ. of London, London, England).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.339-403 (4 April 1983).
The Kosterlitz-Thouless transition in the 2D U(1) σ- or XY-models is studied by the Mayer expansion through the duality transformation. If the inverse temperature β is large, the pressure and the two-point function $\langle\cos(\theta_0-\theta_\zeta)\rangle$ are given by $\Sigma_2{}^\infty a_N(\beta)$ and $\exp[(2/\beta)C_0(\zeta)+\Sigma_2{}^\infty b_N(\beta;\zeta)]$ respectively. Here $C_0(\zeta)\simeq-(2\pi)^{-1}\ \log(|\zeta|+1)$, (i) $|a_N(\beta)|\leq C_1(N)\times\exp[-\beta K_1 N]$, (ii) $|b_N(\beta;\zeta)|\leq C_2(N)\ \exp[-\beta K_2 N]|C_0(\zeta)|$, $K_i>0$. Each term is divergent for $\beta<\beta_c$. The series seems to be absolutely convergent for $\beta>\beta'_c$. (16 refs.)

64852 High-temperature expansion of surface critical exponents for the classical *n*-vector model. K.Ohno, Y.Okabe (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.38-40 (11 April 1983).
The surface critical exponents of the classical n-vector model are investigated in the high-temperature series expansion. The first nine coefficients of the layer susceptibility for the semi-infinite simple cubic lattice are presented. The n-dependence of surface exponents is compared with the results of other theories. (12 refs.)

64853 Surface critical exponents in the 1/*n* expansion. K.Ohno, Y.Okabe (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.41-3 (11 April 1983).
The critical behavior of the semi-infinite ϕ^4 model with O(n) symmetry is studied in the scheme of the $1/n$ expansion. The surface critical exponents $\eta\|$, $\eta\perp$ and λ are calculated up to O($1/n$) for arbitrary spatial dimension d in the case of the ordinary transition. (14 refs.)

64854 Excitation transport on substitutionally disordered lattices. R.F.Lorig, H.C.Andersen, M.D.Fayer (Dept. of Chem., Stanford Univ., Stanford, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1324-7 (25 April 1983).
An exact diagrammatic analysis of transport of electronic excitations among chromophores distributed randomly on a lattice is presented. An approximate solution is obtained that allows calculation of transport properties for transfer rates of any range for any lattice type and any concentration. Simple cubic lattice results are presented for Forster transfer and nearest-neighbor transfer. The latter has a percolation threshold that is described in a qualitatively correct fashion by the authors approximation. (13 refs.)

64855 Interface energy in random systems. B.Derrida (Service de Phys. Theorique, CENS, Gif-sur-Yvette, France), J.Vannimenus.
Phys. Rev. B (USA), vol.27, no.7, p.4401-11 (1 April 1983).
The authors study the interface energy σ as a function of disorder in two-dimensional Ising-type systems at $T=0$ for the percolation and frustration models. Their approach consists in calculating this energy for long strips of varying widths by a random sampling method, then extrapolating the results. In the weak-disorder limit, very wide strips may be studied and accurate values are obtained for the first-order correction to the interface energy in both models. Only moderate widths (up to $N=9$-10) can be studied in the general situation and they use finite-size scaling to analyse the data in the region of the threshold, where σ vanishes with a critical exponent υ. For percolation, they obtain $\upsilon/\nu=0.98\pm0.05$, where ν is the correlation-length exponent, in agreement with Deutscher and Rappaport's proposal (1979) that $\upsilon=\nu$ exactly. The analysis of the results is more difficult in the case of frustration, because size effects are important and the scaling region is not reached for $N=9$. The data show that Monte Carlo results for σ are unreliable and that much care is necessary to reach firm conclusions on the frustration threshold χ_c or the exponents ν and υ. (27 refs.)

64856 Monte Carlo study of weighted percolation clusters relevant to the Potts models. M.Sweeny (Dept. of Phys., Univ. of Chicago, Chicago, IL, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4445-55 (1 April 1983).
The two-dimensional Potts models were simulated with the use of a Monte Carlo method. This study is unique in that the weighted percolation clusters first described by Kasteleyn and Fortuin in 1969 are simulated. An auxiliary data structure is described which enables the author to determine the connectedness of large clusters very efficiently. His simulation of the percolation problem was found not only to be affected by a critical slowing down. Critical exponents were found by studying the size and shape of large clusters. The results agree with previous studies done on integer values of q, and with the conjecture of den Nijs. (22 refs.)

64857 Dilatons as one type of soliton. A.I.Mel'ker (Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1809-10 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3186-8 (Oct. 1982). [received: April 1983]
It was previously shown by the method of molecular dynamics that in one-dimensional crystals (anharmonic chains) the elementary carriers of disruption are dilatons, anomalously extended bonds whose deformation exceeds the elastic limit of the interatomic bonds. The authors explain the form of the dilaton trajectories, and make it possible to understood the unstable character of the vibration spectrum of an anharmonic chain of atoms. (9 refs.)

On the extended characterisation theorem for quantum logics .... See Entry 64716

Markov processes as a tool in field theory .... See Entry 64832

Percolation cluster numbers and effective surface tension .... See Entry 64870

Finite-size analysis of first-order phase transitions: Discrete and continuous symmetries .... See Entry 64871

Nonlinear scaling fields and corrections to scaling near criticality .... See Entry 64872

Configurational entropy of mixtures of molecules having different shapes .... See Entry 64874

Kinetics of a unidirectionally inhomogeneous Ising alloy .... See Entry 67160

Numerical solution of the mean-field theory of the ANNNI model in an external field: a comparison of two methods .... See Entry 67873

The Yang-Lee edge singularity in one-dimensional Isung and *N*-vector models .. .. See Entry 67874

Spontaneous symmetry breaking in spin glasses .... See Entry 67942

Phase separations in Ising model with free boundary condition ....See Entry 67943

Comparison of different boundary conditions for Monte Carlo simulations of Ising models ....See Entry 67944

Diffusion-limited reaction rate theory for two-dimensional systems ....See Entry 68755

Computer simulation of a model for irreversible gelation ....See Entry 68809

05.60 TRANSPORT PROCESSES: THEORY

64858 **Boundary element solutions to steady convective diffusion equations.** M.Ikeuchi (Dept. of Appl. Math., Okayama Univ. of Sci., Okayama, Japan), K.Onishi.
Appl. Math. Modelling (GB), vol.7, no.2, p.115-18 (April 1983).
The boundary element methods, direct and iterative methods, are presented for approximate solutions of two- and three-dimensional convective diffusion equations in a steady state. The direct method uses a fundamental solution to the diffusion-convection operator, while the iterative method utilizes the fundamental solution to the Laplacian. Constant boundary elements are used for the discretization of boundary integral equations. Simple examples are considered to show stability, convergence and accuracy in numerical solutions. (1 ref.)

64859 **The Dufort-Frankel Chebyshev method for parabolic initial boundary value problems.** D.Gottlieb (Tel-Aviv Univ., Tel-Aviv, Israel), L.Lustman.
Comput. & Fluids (GB), vol.11, no.2, p.107-20 (1983).
A pseudospectral explicit method for solving parabolic problems is presented. A stability theorem is proved for model equations, and numerical experiments discussed. (7 refs.)

64860 **A similarity solution of the linearized Boltzmann equation with application to thermophoresis of a spherical particle.** Y.Sone, K.Aoki (Dept. of Aeronaut. Engng., Kyoto Univ., Kyoto, Japan).
J. Mec. Theor. & Appl. (France), vol.2, no.1, p.3-12 (1983).
As an application of the similarity solution, the thermophoresis of a spherical particle with large thermal conductivity is investigated for the whole range of Knudsen number. The result confirms the negative thermophoresis, which has been pointed out by the authors on the basis of the generalized slip flow theory for a slightly rarefied gas. (20 refs.)

64861 **A simple method for calculating diffusional recombination probabilities.** J.E.Larsen, J.B.Pedersen (Fysisk Inst., Odense Univ., Odense, Denmark).
J. Comput. Phys. (USA), vol.49, no.3, p.458-64 (March 1983).
Presents a numerical method for calculating the diffusion-controlled recombination probability of a pair of interacting particles in an isotropic medium with scavengers. The method is finite and has a controllable accuracy. The algorithm is remarkably simple and can be implemented on a programmable pocket calculator. (7 refs.)

64862 **Approach to field-induced stationary state in a gas of hard rods.** J.Piasecki (Center for Studies in Statistical Mech., Univ. of Texas, Austin, TX, USA).
J. Stat. Phys. (USA), vol.30, no.1, p.185-93 (Jan. 1983).
The Boltzmann equation describing one-dimensional motion of a charged hard rod in a neutral hard rod gas at temperature $T=0$ is solved. Under the action of a constant and uniform field the charged particle attains a stationary state. In the long time limit the velocity autocorrelation function decays via damped oscillations. In the reference system moving with the mean particle velocity the decay of fluctuations in the position space is governed (in the hydrodynamic limit) by the diffusion equation. Both the stationary current and the diffusion coefficient are proportional to the square root of the field. It is conjectured that this result also holds for $T>0$ in a strong field limit. (4 refs.)

64863 **Transport of light radiation in a spatially finite three-dimensional scattering medium.** V.A.Savel'ev, S.B.Mogil'nitskii (S.M. Kirov Polytech. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.752-6 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.82-5 (Aug. 1982). [received: April 1983]
The authors propose a new method for solving radiation transport problems, which includes the analytic form for the case of normal incidence and the effect of spatial finiteness of the scattering medium. The formation of the light field accompanying changes in the optical parameters and optical dimensions of the medium is analyzed. They examine the simplest case of a geometry of a scattering medium in the form of a parallelipiped with optical length τ_x, height τ_y, and width τ_z. The analysis is performed for the case $\lambda=1$, $\tau_y=\tau_z$ with the latter varying in the range 0.1 to ∞. The results obtained show that the light field depends strongly on the optical dimensions of the medium. The limiting values of the optical dimensions ($\tau_y=\tau_z$), beginning with which the spatial finiteness of the medium can be neglected, are determined. (11 refs.)

A note on the existence of periodic travelling wave solutions with large periods in generalized reaction-diffusion systems ....See Entry 64705

Self-diffusion for particles with stochastic collisions in one dimension ....See Entry 64828

On the dynamics of excitations in disordered systems ....See Entry 64830

Kinematics of nucleation in a lattice gas model: microscopic theory and simulation compared ....See Entry 64850

The heat equation with singular coefficients. I. Operators of the form $-d^2/dx^2+\kappa/x^2$ in dimension 1 ....See Entry 66444

The application of a modified form of the S_N method to the calculation of swarm parameters of electrons in a weakly ionised equilibrium medium ....See Entry 66660

Diffusion-limited reaction rate theory for two-dimensional systems ....See Entry 68755

Theory of thermophoresis of moderately large aerosol particles ....See Entry 68813

05.70 THERMODYNAMICS

(see also 44.60 Thermodynamic processes, 64. Equations of state, phase equilibria and phase transitions, 65. Thermal properties of condensed matter; for chemical thermodynamics, see 82.60)

64864 **Development of structures in the states far from equilibrium at external regulation.** J.Krempasky (Inst. of Phys., Slovak Acad. of Sci., Bratislava, Czechoslovakia), R.Kveton.
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.2, p.115-28 (1983).
Deals with the formation of new qualities in inorganic, biological and social systems that can be reduced to unbalanced thermodynamic systems. Thus, the possibility to apply laws describing the evolution of unbalanced inorganic systems is given. The subjective factor, corresponding with external regulation is represented through the member expressing changes in systems not resulting from internal dynamics. It has been demonstrated that the presence of this external regulation can either suppress the number of possible new qualities originating under conditions far from equilibrium, or, on the other hand, increase their number and induce the formation of such structures not resulting from laws describing the internal dynamics of systems. In connection with the fact the problem of achieving optimal system management with respect to minimal system entropy is involved. (16 refs.)

64865 **Solution of a one-dimensional phase change problem with non-uniform initial temperature.** R.S.Gupta, D.Kumar (Dept. of Math., Univ. of Roorkee, Roorkee, India).
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.2, p.139-50 (April 1983).
The variable time step methods, proposed earlier by the authors with regard to phase change problems, are applied with some improvements to a problem having a non-uniform initial temperature distribution. A comparison between the numerical results from the present methods and those due to authors, who solve the problem with different techniques, shows a very good agreement. Approximate analytical expressions are also obtained for the temperature distribution as well as for the movement of the interface using the integral method. The computed values from these expressions are found to be very close to those obtained from the numerical methods. (17 refs.)

64866 **The generalized Carnot cycle: a working fluid operating in finite time between finite heat sources and sinks.** M.J.Ondrechen (Dept. of Chem., Northeastern Univ., Boston, MA, USA), M.H.Rubin, Y.B.Band.
J. Chem. Phys. (USA), vol.78, no.7, p.4721-7 (1 April 1983).
The production of work in finite time from a reservoir with finite heat capacity is studied. A model system, for which the only irreversibilities result from finite rates of heat conduction, is adopted. The maximum work obtainable in finite time from such a system is derived, and is found to be strongly dependent upon the reservoir heat capacity. The cycle producing the maximum work is derived for an arbitrary one-component working fluid; no equation of state is assumed. In the optimum cycle, when the working substance is in contact with a finite reservoir, then the temperature of the working fluid is an exponential function of time and the entropy of the working substance is a linear function of time. While the maximum work obtainable in a single fixed-time cycle is a strictly increasing function of the reservoir heat capacity, the efficiency (work produced/heat put in) is a strictly decreasing function of the reservoir heat capacity, for the model system with a finite hot reservoir and an infinite cold reservoir. In the limit where the reservoir heat capacity approaches infinity, the finite-time efficiency approaches the Curzon-Ahlborn efficiency $\eta=1-({T_{\rm low}}^0/{T_{\rm high}}^0)^{1/2}$ for the cycle which produces maximum power. (29 refs.)

64867 **On thermodynamics of non-equilibrium processes.** J.Kratochvil (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia), M.Silhavy.
J. Non-Equilibrium Thermodyn. (Germany), vol.7, no.6, p.339-54 (1982).
A statement of the second law of thermodynamics formulated in the spirit of the classics of the 19th century is shown to yield the existence of the nonequilibrium absolute temperature and nonequilibrium entropy which satisfy the Clausius-Planck dissipation inequality for general processes. A nontraditional form of the first law of thermodynamics employed here is expressed in terms of inequalities analogous to those of the second law. Deep similarities as well as differences between the two laws are thereby revealed. (28 refs.)

64868 **Gibbs' principle and thermodynamic inequalities for nonlinear-elastic bodies.** M.A.Grinfel'd.
Mech. Solids (USA), vol.17, no.3, p.62-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.72-9 (1982).
Proposes a new procedure for obtaining thermodynamic inequalities from Gibbs' principle, that makes it possible to consider solid elastic media in addition to liquid ones. The concept of Gibbs stability of a medium is formulated; in the case of a liquid, this reduces to satisfaction of the classical thermodynamic inequalities. It is shown that the acoustic tensor of a stable nonlinear-elastic material has three nonnegative eigenvalues for any direction of propagation of adiabatic acceleration waves. Thermodynamic inequalities are obtained that characterize a stable isotropic nonlinear-elastic medium in any undistorted configuration. (10 refs.)

64869 **Generalized thermodynamic stability of systems under shear.** C.Perez-Garcia, D.Jou (Dept. de Termologia, Univ. Autonoma de Barcelona, Barcelona, Spain).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.23-6 (11 April 1983).
Starting from the extended irreversible thermodynamics (EIT) theory, some corrections to the specific heat and to the thermal compressibility of a nonequilibrium system are obtained. The authors study the subsequent modifications of the static stability conditions of a system under shear. In some situations, a shear-induced melting transition can be present. (13 refs.)

64870 **Percolation cluster numbers and effective surface tension.** H.Franke, J.Kertesz (Inst. fur Theoretische Phys., Univ. Koln, Cologne, Germany).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.52-6 (11 April 1983).
The authors analyse Monte Carlo calculated cluster numbers n_s for site percolation up to size $s\approx 200$. For the square lattice at concentration $p=0.65$ and the simple cubic lattice at $p=0.35$ they find the asymptotic behaviour $n_s \propto s^{-5/4}\exp(-0.44s^{1/2})$ and $n_s \propto s^{1/9}\exp(-0.09s^{2/3}+0.8s^{1/3}-13.1s^{-1/3})$, respectively. Applying the surface concept they compute an effective surface tension on the basis of these results. Because of the large negative $s^{-1/3}$ term, however, the concept does not work for small clusters in three dimensions. (12 refs.)

64871 Finite-size analysis of first-order phase transitions: Discrete and continuous symmetries. J.L.Cardy (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA), P.Nightingale.
Phys. Rev. B (USA), vol.27, no.7, p.4256-60 (1 April 1983).
First-order phase transitions are characterised by δ-function singularities in thermodynamic quantities. The way in which these singularities develop in taking the thermodynamic limit is qualitatively different for finite systems and systems infinite in one direction only. The corresponding crossover behaviour, which the authors predict in detail with a renormalisation-group analysis, is a unique feature of first-order transitions and is suggested to be of considerable utility. Both systems with discrete and continuous symmetries are discussed. For the latter they verify their results for the two geometries within the spin-wave approximation. (15 refs.)

64872 Nonlinear scaling fields and corrections to scaling near criticality. A.Aharony (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel), M.E.Fisher.
Phys. Rev. B (USA), vol.27, no.7, p.4394-400 (1 April 1983).
Thermodynamic functions in the vicinity of an ordinary critical point are expected to obey asymptotic scaling laws as $t=(T-T_c)/T_c$ and the ordering field, h, approach zero. However, the optimal scaling variables are the nonlinear scaling fields, $g_t=t+b_th^2+c_tt^2+\ldots$ and $g_h=h(1+c_ht+\ldots)$. The nonlinearities yield correction factors to the leading power-law (and scaling) variation of thermodynamic quantities, L, of the form $(1+a_Lt+b_Lt^2+\ldots)$, etc. where the correction amplitudes $a_L, b_L, \ldots$, are uniquely determined by the nonlinear scaling-field coefficients. It follows that 'analytic' corrections to, e.g. the susceptibility, are directly related to those for the free energy and magnetisation (in zero field). The term b_th^2 also generates nonanalytic contributions such as an additive, energylike term, varying as $|t|^{1-\alpha}$ in the zero-field susceptibility, and factors like $(1+c_L|h|^{2-1/\Delta})$ on the critical isotherm, $t=0$. Irrelevant scaling fields yield further, in general distinct, nonanalytic corrections, and cause shifts in T_c and various amplitudes although 'universal' ratios remain constant. (22 refs.)

64873 The Einstein and Hopf work revisited. J.L.Jimenez, G.del Valle (Facultad de Ciencias, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.259-66 (Feb. 1983).
Einstein and Hopf's work is discussed and, taking into account the radiated energy by the dipole during the fluctuations and the zero point field, the authors deduce Planck's radiation law. (7 refs.)

64874 Configurational entropy of mixtures of molecules having different shapes. E.P.Sokolova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.115-17 (Feb. 1983). In Russian.
Thermodynamic properties of monomer-parallelepiped systems based on the lattice model are calculated. Parallelepipeds with different length-to-width ratios are considered. Activity coefficients in mixtures of hard cubes are shown to be in good agreement with those of hard spheres. (11 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior ....See Entry 64582

Deriving $S=k\ln\Omega$ ....See Entry 64633

Brownian motion, the second law and Boltzmann ....See Entry 64825

Study of the Kosterlitz-Thouless transition by the Mayer expansion ....See Entry 64851

Interface energy in random systems ....See Entry 64855

Monte Carlo study of weighted percolation clusters relevant to the Potts models ....See Entry 64856

A new proof and generalization of the maximum principle of heat conduction ....See Entry 66445

Molecular dynamics simulations of the rheological properties of simple fluids ....See Entry 66600

On the thermodynamics of the two-dimensional jellium ....See Entry 66678

Functional integral approach to the Falicov-Kimball model ....See Entry 67163

A molecular theory for the freezing of hard spheres ....See Entry 67165

Classical field descriptions of one-dimensional systems ....See Entry 67941

Lepton loss and entropy generation in stellar collapse ....See Entry 69633

The future of the Universe ....See Entry 69767

06.00 MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS

06.20 METROLOGY

06.20F Units

64875 Progress in the realization of the units of capacitance, resistance, and inductance at the National Physical Laboratory, India. S.L.Dahake, R.N.Dhar, A.K.Saxena, V.K.Batra, K.Chandra (Nat. Phys. Lab., New Delhi, India).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.5-8 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Describes the progress made at the National Physical Laboratory (NPL), New Delhi, India, in the realization of the units of capacitance and resistance based on a calculable cross-capacitor. The realization of the unit of inductance in terms of capacitance using the Maxwell-Wein bridge and resonance techniques has also been described. (7 refs.)

06.20H Measurement standards and calibration

64876 Selecting Zener diodes for maximum stability [calibration standard].
Electron. Prod. Des. (GB), vol.4, no.3, p.59-60 (March 1983).
Describes the Datron 4000 Autocal Standard calibrator. The specification includes full IEEE-488 programmability of its output, including continuous scaling of all ranges. This implied electronic switching of its divider circuitry and, since the full accuracy and stability of less than 5 ppm/year—and noise of less than 1 ppm of range—were to be maintained throughout all of its ranges, the use of Zener diodes for its internal reference. The divider aspect was resolved by the use of a variable duty cycle pulse train which operates an FET switch between the reference voltage and ground and the output is averaged to the required derived voltage by a seven-pole Bessel filter. (no refs.)

Remarks about calibration of automatic analyser of aerosols .See Entry 64883

Time and frequency standards based on charged particle trapping ....See Entry 64889

General method of calculating self-consistent calibration curves for optical pyrometers ....See Entry 64908

Wavenumber calibration of Fourier transform spectra ....See Entry 64964

An absolutely calibrated source of 6.13 MeV gamma-rays ....See Entry 65793

Calibration of an analyzing magnet using a time-of-flight technique ....See Entry 65795

06.20J Determination of fundamental constants

64877 Determination of the fine structure constant using MOS devices. K.Yoshihiro.
Solid State Phys. (Japan), vol.17, no.12, p.735-43 (Dec. 1982). In Japanese. [received: April 1983]
The possibility of the fine structure constant determination has been reviewed on the basis of recent precision measurements of the quantized Hall effect. (39 refs.)

06.30 MEASUREMENT OF BASIC VARIABLES

Measurement of low oxygen pressures with a solid-state electrolyte miniaturised sensor ....See Entry 64894

A sensitive 6-component high-frequency-range balance for building aerodynamics ....See Entry 64895

A realtime ruby luminescence spectrometer for pressure determinations ....See Entry 64958

06.30C Spatial variables measurement

(inc. measurement of all variables extending in space e.g. diameter, height, thickness, displacement, surface topography, particle size, area of disperse systems)

64878 A new microcomputer-controlled laser dimensional measurement and analysis system. R.C.Quenelle, L.J.Wuerz (Hewlett-Packard & Co., Palo Alto, CA, USA).
Hewlett-Packard J. (USA), vol.34, no.4, p.3-4, 6-13 (April 1983).
Describes a microcomputer-controlled instrument from Hewlett-Packard. The 5528A Laser Measurement System consists of a laser head, a measurement display, and precision optical components. It measures linear position, pitch and yaw, straightness, squareness, flatness, and parallelism. (3 refs.)

64879 Automatic compensation [for laser beam measurement system]. D.A.Gardner (Hewlett-Packard Co., Palo Alto, CA, USA).
Hewlett-Packard J. (USA), vol.34, no.4, p.12 (April 1983).
Describes instruments which, when attached to Hewlett-Packard's HP 5528A Laser Measurement System, compensate for changes in atmospheric conditions and for changes in the sample temperature. The air sensor contains devices to measure air pressure, temperature and humidity, and feeds these results as voltages to the instrument's calibrator control unit. The material temperature sensor also gives a voltage to the calibrator so that results can be normalised to 20°C. (1 ref.)

64880 Apparatus for measuring the thermal expansion of solids between 1.5 and 380K. R.Pott, R.Schefzyk (II. Phys. Inst., Univ. zu Koln, Koln, Germany).
J. Phys. E (GB), vol.16, no.5, p.444-9 (May 1983).
Describes a device for measuring the thermal expansion of solids in the temperature range from 1.5 to 380K, based on a three-terminal capacitor method. The construction of the expansion cell allows a fast mounting of the sample without dismantling of the cell, the sample shape being unimportant. The relative sensitivity is $\Delta l/l=10^{-10}$ for $l=10$ mm. The systematic error is in the order of 10^{-7}. The thermal expansion coefficient can be determined with a sensitivity of 10^{-9} K^{-1} and an accuracy of $\pm 2\%$. (9 refs.)

64881 Real-time longitudinal displacement analysis of rough surfaces by observing fringes within objective laser speckles. C.S.Vikram, K.Vedam (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Optik (Germany), vol.64, no.2, p.171-5 (May 1983).
A method of real-time observation of usual interference fringes within objective laser speckles is described. This is achieved by illuminating a small object area for larger speckle size and further magnifying the pattern by a TV camera to finally observe significantly large speckles on the monitor. Experimental results obtained using Michelson type of arrangement are described for the measurement of longitudinal object movement. (19 refs.)

64882 Measurement of long radius of curvature. M.V.R.K.Murty (Centro de Investigaciones en Optica AC, Leon, Mexico), R.P.Shukla.
Opt. Eng. (USA), vol.22, no.2, p.231-5 (March-April 1983).
Reviews several methods for the measurement of very long radius of curvature of a convex or concave spherical mirror. These methods have relevance in the measurement of the radii of curvature of laser mirrors. The accuracies achievable with the various methods are compared and summarized. (5 refs.)

64883 Remarks about calibration of automatic analyser of aerosols. A.Drobnik, K.Lukaszewski, K.Pieszynski, Z.Ulanowski (Inst. of Phys., Tech. Univ., of Lodz, Lodz, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.253-6 (1982).
The working principles of the instrument, called an automatic analyser of aerosols (AAA), are presented. Certain problems arising during calibration which are important in interpretation of the measurements are discussed. (2 refs.)

64884 A generalized speckle interferometry method for measuring the arbitrarily oriented (small) displacements of a rigid body. W.Urbanczyk, I.Wilk (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.260-5 (1982).
A simple speckle interferometry method has been presented for measuring the rigid body displacements oriented perpendicularly to both the free propagating laser beam illuminating the object and the reflected beam producing the respective speckling pattern. Also, the lower and upper bound limits of the measuring range were discussed. The principles of a generalized method and the respective setup are considered which allow one to measure the displacements of arbitrary orientations with respect to the light beams used. This method is introduced in two versions: as a free-propagation method, and as a diffuser method. (1 ref.)

64885 Multiplier-type angle-measuring optical systems. P.A.Mikheev.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.483-4 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.13-15 (Aug. 1982). [received: April 1983]
The construction schematics of multiplier-type angle-measuring optical systems are examined. The laws governing the formation of images in systems containing diffraction gratings are derived. The high angular sensitivity of the described systems is demonstrated experimentally. (5 refs.)

64886 Ultrasonic-resonance method of determining transverse dimensions for fine fibers and wires. S.V.Veremeenko, V.G.Meierson (All-Union Sci.-Res. Inst. of Nondestructive Testing, Kishinev, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.579-83 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.3-7 (Aug. 1982). [received: April 1983]
A procedure has been developed for determining the dimensions and radius of inertia for the cross section of fibres and wires by an ultrasonic-resonance method. A description is given of the instrument's block diagram and the design of its acoustic channel. Measuring results for the diameters of fine fibers made of various materials are given. (6 refs.)

64887 Measuring procedure for transverse dimensions of fine rods and wires by the ultrasonic-resonance method. V.G.Meierson.
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.583-9 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.7-13 (Aug. 1982). [received: April 1983]
An analytical procedure is developed for the spectrum of natural-frequency vibrations of a rod having free boundaries, and also experimental criteria for the correspondence between the rod's characteristics and its acoustic model. The procedure can be applied in many measuring problems using the ultrasonic-resonance method, especially for checking the transverse dimensions of fine rods. (6 refs.)

64888 A radioisotope method of thickness measurement for rhodium plating on rings. V.V.Kazantsev, L.S.Voronova (Mendeleev All-Union Metrology Res. Inst., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.660-2 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.88-91 (Aug. 1982). [received: April 1983]
Measurements have been made of the coating thicknesses on rings from a single batch by radioisotope and gravimetric methods in order to develop an effective method for measuring the thickness of rhodium plating on rings of diameter 20-200 mm that are polished after electroplating. The data indicate that the radioisotope method is preferable as regards providing reliable information on the local and average thicknesses. The error of measurement is ±0.25 μm in the range 2-3 μm and satisfies production requirements. The TPRU-1 radioisotope thickness gauge can be used with GSO 1624-79 standard specimens and an attachment for measuring coating thickness on rings in a routine and acceptance monitoring of coating thickness. (3 refs.)

Double-exposure speckle photography for the measurement of small displacements ......See Entry 64609

Measurement sensors. II. Proximity sensors ......See Entry 64896

An inexpensive liquid helium level sensing unit ......See Entry 64911

A capacitive instrument for the measurement of magnetostriction in pulsed fields ......See Entry 64922

Optical profilometer in white light ......See Entry 64938

Accuracy of an optical open area ratiometer ......See Entry 64939

Ellipsometric studies of rough silicon surfaces ......See Entry 64942

A moire fringe alignment aid ......See Entry 64946

Scanning tunnelling microscopy ......See Entry 64999

Laser optical components for machine tool and other calibrations ......See Entry 66317

The accuracy of distance measurements with laser pulse ......See Entry 66318

Testing the quality of the operating surface of a parabolic devitrified glass astronomical mirror ......See Entry 66366

A monocular camera based measurement system using the thin lens approximation ......See Entry 66369

Self-calibrating surface measuring machine ......See Entry 66414

Displacement measurements around cracks in three-dimensional problems by a hybrid experimental technique ......See Entry 66512

Optical heterodyne measurement of vibration phase ......See Entry 66527

A method of three-dimensional strain measurement on non-ideal objects using holographic interferometry ......See Entry 66533

Transient response of a central crack to a tensile pulse ......See Entry 66536

Non-destructive determination of composition and thickness of multi-component alloy thin films by X-ray fluorescence spectroscopic method ...See Entry 67378

06.30E Mass and density measurement

Magnetic-fluid density spectrometer with constant ($H^{©}$)H ......See Entry 64923

06.30F Time and frequency measurement

(for astronomical aspects see 95.70)

64889 Time and frequency standards based on charged particle trapping. W.M.Itano, D.J.Wineland, H.Hemmati, J.C.Bergquist, J.J.Bollinger (Time & Frequency Div., NBS, Boulder, CO, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1521-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Microwave or optical frequency standards based on internal resonance transitions of ions confined in electromagnetic traps have the fundamental advantages of long observation times and small perturbations. These advantages are somewhat offset by low signal to noise ratios. Work at NBS has concentrated on microwave hyperfine transitions of atomic ions stored in Penning-type ion traps. The use of narrowband, tunable light sources for state selection and detection and for reducing the average kinetic energy of the ions (laser cooling) is an important feature of this work. Results to date include the fluorescence detection and cooling to about 50 mK of a single Mg ion and the observation of a 0.012 Hz linewidth on a 300 MHz $^{25}Mg^{+}$ hyperfine transition. A frequency standard based on ^{201}Hg ions is under development. (21 refs.)

06.30L Measurement of basic electromagnetic variables

(see also 07.50 Electrical instruments and techniques)

High-resolution probing of surface-charge distributions on electret samples ......See Entry 64919

Spectroscopic Doppler-free methods for measuring the electric and magnetic fiels in magnetically insulated ion diodes ......See Entry 66758

06.50 DATA HANDLING AND COMPUTATION

(see also 02.70 Computational techniques; 29.80 Nuclear information processing; for optical data processing, storage and retrieval see 42.30; for geophysical data acquisition and storage see 93.65)

64890 Unleashing a microcomputer in the laboratory. III. K.G.McConnell (Dept. of Engng. Sci. & Mech., Iowa State Univ., Ames, IA, USA), M.Abdelhamid.
Exp. Tech. (USA), vol.7, no.3, p.28-30 (March 1983).
For pt.II see ibid., vol.7, no.2, p.38 (1983). Presents an application of interest to a great number of engineers and researchers: the use of the PET as a data logger. The low price of the PET microcomputer makes it a viable option especially in development systems. The requirements for building a data logger that uses the PET and the use of this system in a specific application are discussed. (5 refs.)

64891 Accuracy of semiautomatic measurements on digitizing equipment. V.Smolej (Max-Planck-Inst. fur Metallkunde, Inst. fur Werkstoffwissenschaften, Stuttgart, Germany).
Prakt. Metallogr. (Germany), vol.20, no.3, p.138-49 (March 1983).
Carefully controlled experiments on a semiautomatic stereological equipment (KONTRON Videoplan with a digitizer tablet as the primary data input device) have shown that factors like different measuring probes (cursor or stylus) and the arrangement of intercepts significantly influence the final results. Usually the errors due to sampling are the main source of variation—besides the original variation of data. These errors are usually much larger than those discussed; thus one can safely assume that the errors due to different measuring probes are negligible, as well as the errors due to intercept arrangement. (4 refs.)

A microcomputer-controlled automatic inverted torsion/flexure pendulum and realtime data processing system for low-frequency internal friction studies ......See Entry 64901

A polynomial fitting procedure for the determination of the moments of NMR lines in polymers from the truncated FID ......See Entry 66156

Computer coupling of phase diagrams and thermodynamics ......See Entry 67158

The computer increases the sharpness of X-ray diagnosis ......See Entry 68997

A PDP-11 assembly language program for digitizing, sorting, and averaging evoked brain potentials ......See Entry 69033

Digital-to-analog converter unit ......See Entry 69346

A device for converting analog records of autonomous ocean-bottom seismograph systems into digital form and recording on a digital tape recorder in ES computer format ......See Entry 69348

A floating point formatter for digitally recording seismic systems ......See Entry 69354

06.60 LABORATORY TECHNIQUES

64892 Calculation of the characteristics of an induction-type MHD pump for $R_{m}s>1$ with allowance for the nonuniform distribution of the external magnetic field. R.A.Valdmane, I.R.Kirillov, A.P.Ogorodnikov, V.P.Ostapenko, L.Ya.Ulmanis.
Magnetohydrodynamics (USA), vol.18, no.3, p.293-9 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.98-104 (July-Sept. 1982). [received: April 1983]
One of the features characteristic of a large induction pump with planar or cylindrical channels working at high electromagnetic-interaction parameters ($R_{m}s>1$) is the instability in the homogeneous flow of liquid metal due to the demagnetizing action of the secondary currents. As a result, the velocity profile over the width of the channel becomes inhomogeneous, and the integral characteristics may differ substantially from those calculated in the electrodynamic approximation. This inhomogeneity can be reduced (for $R_{m}s<1$) or accentuated (for $R_{m}s>1$) by design features of the pump, in particular the inhomogeneity in the nonmagnetic gap and by unilateral input (output) of the liquid metal. The authors compare the observed characteristics of a cylindrical induction pump with calculations from various approximate models on the basis of the actual magnetic field distribution. (9 refs.)

A combined vacuum interlock and preparation assembly for MBE and surface analysis ......See Entry 64914

A compact synchroscan streak camera using a microchannel plate incorporated tube ......See Entry 66046

06.70 GENERAL INSTRUMENTATION

64893 Fast time-interval 'scope.
Electron. Prod. Des. (GB), vol.4, no.4, p.79-80 (April 1983).
Offering 50 ps accuracy and 10 ps resolution, the HP 1726Z Time-Interval oscilloscope described combines counter and 'scope technologies to make fast, reliable timing measurements on complex, repetitive signals. It has the viewing and measuring capabilities of a 275 MHz oscilloscope and the user features of a time-interval counter, and is intended for applications involving frequent high-precision timing measurements. (no refs.)

64894 Measurement of low oxygen pressures with a solid-state electrolyte miniaturised sensor. F.J.Gutierrez Monreal (Inst. de Electronica de Comunicaciones, CSIC, Madrid, Spain), G.Vitter.
J. Phys. E (GB), vol.16, no.5, p.361-4 (May 1983).
An electrochemical gauge with internal reference is applied for measuring partial oxygen pressures. This device has been applied to measure the oxygen coming from the $H_2+{}^1/_2O_2 \rightleftarrows H_2O$ reaction, made at low oxygen pressures down to 10^{-39} atmospheres ($\approx 10^{-34}$Pa). The results showed that the accuracies obtained were about 1.5% between the measured values and the theoretical ones. The scheme of the gauge and its method of calibration is also presented, taking account of the fact that the internal reference allows the measurement of such low oxygen pressures. (7 refs.)

64895 A sensitive 6-component high-frequency-range balance for building aerodynamics. N.J.Cook (Dept. of the Environment, Garston, Watford, England).
J. Phys. E (GB), vol.16, no.5, p.390-3 (May 1983).
A wind tunnel balance capable of measuring all six components of force and moment at the base of building models over the frequency range <0.00016 Hz to 500 Hz has been built by Kistler Instruments to Building Research Establishment (BRE) specifications. The form and performance of the balance which employs standard piezoelectric force transducers are described, and two examples of typical research applications illustrated. (6 refs.)

64896 Measurement sensors. II. Proximity sensors.
J. Equip. Electr. & Electron. (France), no.485, p.43-4 (Jan.-Feb. 1983). In French.
For pt.I see ibid., no.484, p.53 (1982). Deals with sensors which give an 'on-off' signal as soon as a particular object or 'target' approaches them without actual contact. There are the so-called magnetic switches, inductive sensors, magnetic sensors, the Hall effect sensors which provide a signal of constant amplitude regardless of the speed of passage of the target, photoelectric sensors and ultrasonic sensors, the operating characteristics of all of which are briefly and clearly described. Also provided is a list of leading French manufacturers of the various types of sensor discussed. (no refs.) *G.E.P.*

64897 Versatile new oscilloscopes with DMM and counter functions.
JEE (Japan), vol.20, no.193, p.96-7 (Jan. 1983).
Describes the model SS-5711D oscilloscope, which combines in one unit the new SS-5711, four-channel with 100 MHz band, a low-cost, high-performance oscilloscope, with a four-position, floating-decimal digital multimeter and an eight-position universal counter. With reduced processing time made possible by high-speed components and better software, the operating speed of recent electronic devices has been dramatically increased. For the wideband oscilloscopes needed to measure these faster devices, this and other low-cost 100 MHz oscilloscopes are being marketed. Low cost is attained without sacrificing quality by applying value-engineering techniques, shortening assembly time with improved circuit design, and the introduction of automated manufacturing processes. (no refs.)

64898 Digital memory scopes offer more varied functions. S.Tanaka.
JEE (Japan), vol.20, no.194, p.69-71 (Feb. 1983).
Discusses the digital storage oscilloscope, with a built-in analog-to-digital (A/D) converter-based digital memory which is a waveform-memorizing instrument. The digital memory scope can store waveforms and instantly reproduce them. This feature, not found in conventional oscilloscopes, has been found suitable for fast-changing waveform analyses, especially for transient, single-shot, unexpected phenomena. With its highly valued capabilities, the digital memory scope has drawn increasing market interest. (no refs.)

64899 Determination of the optimum number and disposition of single ferrosonde transducers. L.V.Kapusta, V.A.Tregubov (Voroshilovgrad Engng. Inst., Voroshilovgrad, Ukrainian SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.618-20 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.44-7 (Aug. 1982). [received: April 1983]
Suggests a method of determining the optimum number and disposition of single ferrosonde transducers in designing multielement ferrosonde transducers for inspecting flat ferromagnetic products. (6 refs.)

64900 The ferrosonde flaw detector DFP-1. N.N.Zatsepin, A.P.Gusev (Inst. of Appl. Phys., Acad. of Sci., Belorussian SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.651-3 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.79-82 (Aug. 1982). [received: April 1983]
The operating principle of ferrosonde flaw detectors is based on the magnetization of the product parallel to the inspected surface and detecting flaws with the aid of a gradiometric ferrosonde along the normal component of the magnetic field intensity. The flaw detector consists of an electronic unit and a sensor incorporating the functions of magnetizing, scanning and reading. The sensitivity and reliability of the ferrosonde in detecting flaws were verified under laboratory conditions on specimens of various steels with natural and artificial flaws. (8 refs.)

Automatic compensation [for laser beam measurement system] .... See Entry 64879

Transistor transducer for measuring surface temperature ....See Entry 64903

An inexpensive liquid helium level sensing unit ....See Entry 64911

High-resolution probing of surface-charge distributions on electret samples ....See Entry 64919

Integrated optics wave front measurement sensor ....See Entry 66409

Rotating nulear demagnetization refrigerator for experiments on superfluid He^3 ....See Entry 67299

Visualization of the results of flaw detection on a color-television screen ....See Entry 68744

07.00 SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS

(see also within each subdiscipline for specialized instrumentation and techniques)

07.10 MECHANICAL INSTRUMENTS AND MEASUREMENT METHODS

(for measurement in the mechanics of solids and rheology, see 46.30R; for materials testing, see 81.70)

64901 A microcomputer-controlled automatic inverted torsion/flexure pendulum and realtime data processing system for low-frequency internal friction studies. K.Iwasaki (Inst. of Phys. & Chem. Res., Saitama, Japan).
J. Phys. E (GB), vol.16, no.5, p.421-6 (May 1983).
An internal friction measuring apparatus of an inverted pendulum type is developed, in which a specimen is vibrated either in a torsional or in a flexural mode at low frequency. The counterweight of the pendulum can be varied stepwise from outside at any temperature and the specimen elongation is detectable. Fully automatic measurement and realtime data procession are performed with the use of a microcomputer and the experimental results are immediately displayed on a *X-Y* plotter as a graph and on a graphic printer as a data table. (6 refs.)

High viscosity (10^4-10^{11} Pa.s) measurements by the penetrometer method at low temperature (77-300K) ....See Entry 66656

A facility for precise measurement of mechanical properties at elevated temperatures ....See Entry 68721

A plane strain tensile apparatus ....See Entry 68722

High pressure fatigue testing with results for tubing and fittings ....See Entry 68726

07.20 THERMAL INSTRUMENTS AND TECHNIQUES

(see also 44.50 Thermal properties of matter, 44.60 Thermodynamic processes; for radiometry and detection of thermal radiation see 07.60D and 07.62)

Apparatus for measuring the thermal expansion of solids between 1.5 and 380K ....See Entry 64880

Calculation of fast-response low-temperature bolometers on a solid substrate ... .See Entry 64953

07.20D Thermometry

64902 Noncontact surface temperature measurement during reactive-ion etching using fluorescent polymer films. P.Kolodner, A.Katzir, N.Hartsough (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.749-51 (15 April 1983).
The authors have used a fluorescence technique to make a noncontact surface-temperature measurement on a thin film of glass resin as it is etched away in a reactive-ion-etching chamber. The glass resin is heavily doped with a flourescent material whose fluorescence lifetime is temperature dependent. The fluorescence is excited and collected through a remote optical fiber, and the lifetime is measured using a phase-shift technique. The calibration reproducibility of this measurement is about ± 1°C. The fluorescent glass-resin film could be used as an underlayer for monitoring the etching of overlying oxides, photoresists, or patterned metallizations, or a photoresist itself could be doped with the fluorescer. This demonstration opens up the possibility of surface temperature measurement in a wide variety of harsh environments. (6 refs.)

64903 Transistor transducer for measuring surface temperature. V.M.Karastoyanov.
Elektro Prom.-st. & Priborostr. (Bulgaria), vol.18, no.1, p.20-1 (1983). In Bulgarian.
The author describes the design of a transducer for measuring the surface temperature of bodies, in which a silicon transistor chip is used as thermosensitive element. He describes further the key diagram of the amplifier, the method of calibration, the basic error and the thermal time constant. (3 refs.)

64904 Temperature measurement with thermoelements. W.Taetow.
Funkschau (Germany), no.6, p.53-5 (18 March 1983). In German.
After a general introduction into the conventional methods of measuring temperature by means of a thermoelement, usually by a constantan (Cu-Ni alloy) sensor, compensated by a constant temperature reference (usually a beaker with ice), the simple to use all electronic AD 594 instrument of Analog Devices is described in some detail. The core of the equipment is a single IC, containing a low-drift operational amplifier for the sensor input, the compensating reference sensor with automatic supply voltage control, error detector and summing amplifier, and a final output stage, yielding a test voltage of 10 mV/°C. The thermoelement self-compensation is based on the symmetrical circuit containing three different metal pair sensors. Illustrations comprise block diagrams, a typical readout table, voltage/temperature characteristic (up to 300°C) and circuit arrangements for two typical applications (warning alarm, threshold indicator). (no refs.) *A.L.*

07.20F Calorimetry

64905 Long path length samples in thermal lens calorimetry. C.A.Carter, J.M.Harris (Dept. of Chem., Univ. of Utah, Salt Lake City, UT, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.166-72 (March-April 1983).
Laser-induced thermal lens calorimetry as applied to small absorbance determinations has traditionally relied upon the approximation that the sample behaves optically as a thin lens. The choice of a cell length which is not ideal for theory may be necessary for increased sensitivity. Two models for treating long samples of variable absorbance and enhancement are presented. The simpler of these is based on an approximation that such samples will behave according to the integrated position dependence of a thin lens. A more complex model, requiring numerical evaluation, includes the effects of sample refractive index and lens element coupling. (20 refs.)

64906 A new high-precision continuous-heating differential calorimeter for the temperature range 1.5K to 300K. J.W.Loram (School of Math. & Phys. Sci., Univ. of Sussex, Brighton, England).
J. Phys. E (GB), vol.16, no.5, p.367-76 (May 1983).
A method is described in which the ratio of the heat capacities of two samples is measured with an accuracy which approaches $1{:}10^4$ between 20K and 200K, but which decreases to $1{:}10^3$ at 1.5K and 300K. The resolution of the system is very much higher than this, and may approach $1{:}10^6$ over a limited temperature range. The system is extremely simple to operate being the thermal analogue of a Wheatstone bridge, and measurements may be taken rapidly at closely spaced temperature intervals. The construction of the calorimeter, which contains several new features, is also described. (3 refs.)

64907 An isothermal calorimeter with pneumatic compensation—principles and application. L.Ter Minassian, F.Milliou (Lab. de Chimie Phys., Pierre et Marie Curie, Paris, France).
J. Phys. E (GB), vol.16, no.5, p.450-5 (May 1983).
The fundamental principles of pneumatic calorimetry are presented together with a detailed analysis of an experimental application. The apparatus belongs to a new class of instrument based on the reversible liberation of a quantity of heat following a pressure effect exercised on an ideal gas. This device allows the precise measurement of a quantity of heat $+q$ by opposing a known antagonist effect $-q$ determined from the pressure variation. A thermal feedback is realised, wherein the pressure is servocontrolled by a temperature signal. The system allows absolute determinations and is highly accurate and sensitive. Performance, corrections and limitations are studied and discussed. (5 refs.)

Calorimetry and psiumetry .... See Entry 68929

07.20K High-temperature techniques and instrumentation; pyrometry

64908 General method of calculating self-consistent calibration curves for optical pyrometers. B.I.Zinzikov, A.N.Borets (Uzhgorod Univ., Uzhgorod, USSR).
High Temp. (USA), vol.20, no.4, p.613-17 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.733-7 (July-Aug. 1982). [received: April 1983]
The general integral expression for the absolute radiation flux perceived by a pyrometer is transformed by means of incomplete gamma functions into a form suitable for computer use. The temperature dependence of the spectral blackness coefficient of the object is incorporated by making the calibration curves self-consistent. (7 refs.)

Colloquium on 'High Temperature Electronics' .... See Entry 64597

Measurement of the electrical conductivity of liquid metals by the eddy-current method .... See Entry 64916

Heating unit for mechanical testing of heat-resistant alloys at high temperatures .... See Entry 68717

A facility for precise measurement of mechanical properties at elevated temperatures .... See Entry 68721

07.20M Cryogenics

64909 A horizontal dilution cryostat for polarized targets used in a high intensity photon beam. W.Meyr, K.H.Althoff, O.Kaul, H.Riechert, E.Schilling (Phys. Inst., Univ. Bonn, Bonn, Germany).
AIP Conf. Proc. (USA), no.95, p.517-19 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A horizontal continuous flow ^{3}He-cryostat was modified to a dilution cryostat with special regard to fast cool-down and easy loading of the target material. This dilution cryostat, built for target asymmetry measurements with a photon beam, has a cooling power of 5 mW at 0.2K, 20 mW at 0.3K and 34 mW at 0.4K. The lowest temperature attained was 175 mK. Target asymmetry measurements of the reaction $\gamma d\uparrow \rightarrow pn$ at $\Theta_{CM}{}^{P}=125°$ were performed using the external photon beam of the Bonn 2.5 GeV electron synchrotron. As target material the authors used D-butanol ($C_4D_{10}O$) with a maximum deuteron polarization of 27% in a magnetic field of 2.5 T. Under the same conditions deuterons in D-ammonia (ND_3) could be polarized up to 30%. (8 refs.)

64910 Measurement of friction factors for the flow of gases in very fine channels used for microminiature Joule-Thomson refrigerators. W.Peiyi, W.A.Little (Phys. Dept., Stanford Univ., Stanford, CA, USA).
Cryogenics (GB), vol.23, no.5, p.273-7 (May 1983).
The friction factors for the flow of gases in the fine channels used for microminiature Joule-Thomson refrigerators have been measured. The test channels were fabricated using a photolithographic technique. The width of the channels were 130 to 200 microns and the depth 30 to 60 microns. The tests involved both laminar and turbulent flow regimes. The results obtained show some interesting characteristics of flow resistance for very fine channels. These differ from ones for common pipes because of the large relative roughness and asymmetric roughness. (10 refs.)

64911 An inexpensive liquid helium level sensing unit. S.C.Bapna, M.Pravinkumar, M.Thirumaleshwar (Cryogenics Section, Bhabia Atomic Res. Centre, Bombay, India).
Cryogenics (GB), vol.23, no.5, p.278-9 (May 1983).
Two units to measure the level of liquid helium in a superconducting magnet and in a storage Dewar are described. (3 refs.)

64912 Characterization of multilayer insulation at cryogenic temperature. H.Kishan, R.B.Saxena, M.L.Sharma, R.G.Sharma (Nat. Phys. Lab., New Delhi, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.965-8 (Dec. 1982). [received: April 1983]
Apparent thermal conductivity ($\bar{k}$) measurements have been carried out on multilayer insulation or the so called superinsulation consisting of alternate layers of indigenous aluminium foil (9 μm thick) and 'Dexter' fibre glass paper (170 μm thick) between the boundary temperatures of 300 and 77K under varying gas pressure and layer density. An NBS-type double-guarded calorimeter fabricated at the laboratory has been used for these studies. The heat transfer through the insulation has been measured in terms of the rate of evaporation of liquid nitrogen in the test vessel by the usual method of a water bubbler and a wet gas flow meter. No better material has been used in the calorimeter during the measurements. A minimum value of $k \simeq 0.38$ μW cm^{-1} K^{-1} has been obtained for a density of 24 layers/cm and at a pressure of 2.5×10^{-5} torr. (10 refs.)

64913 Recent progress in ^{4}He-circulating dilution refrigerators. T.Sato, N.Sato.
Solid State Phys. (Japan), vol.18, no.1, p.47-5 (Jan. 1983). In Japanese.
After reviewing the problems in a ^{4}He-circulating dilution refrigerator, the authors present results of their recent investigation and also those of the Leiden group. (3 refs.)

Horizontal dilution refrigerator for use in intense proton beams .... See Entry 65750

A double target cell cryostat with quick interchange of target cells .... See Entry 65752

Rotating nulear demagnetization refrigerator for experiments on superfluid He^3 .... See Entry 67299

Variability in mechanical performance of G-10CR cryogenic-grade insulating laminates .... See Entry 68594

07.30 VACUUM PRODUCTION AND TECHNIQUES

(inc. pressures below 1 atmosphere; see also 47.45 Rarefied gas dynamics; 81.15G Vacuum deposition)

64914 A combined vacuum interlock and preparation assembly for MBE and surface analysis. T.G.Andersson, B.Nilsson, S.P.Svensson, E.Flemming (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
J. Phys. E (GB), vol.16, no.5, p.364-6 (May 1983).
A vacuum interlock system for sample transfer into an interlock carousel station is described. In this station samples can be stored and prepared before being further transferred into an MBE (molecular beam epitaxy) system of an auxiliary analysis chamber. The described system is a redesign of the commercial load-lock system on the Varian MBE-360 system. (2 refs.)

Measurement of low oxygen pressures with a solid-state electrolyte miniaturised sensor .... See Entry 64894

07.35 HIGH PRESSURE PRODUCTION AND TECHNIQUES

(inc. pressures above 1 atmosphere)

A realtime ruby luminescence spectrometer for pressure determinations .... See Entry 64958

High pressure fatigue testing with results for tubing and fittings .... See Entry 68726

07.50 ELECTRICAL INSTRUMENTS AND TECHNIQUES

64915 Problems of the theory and design of electromagnetic mechanisms with flat printed coil. D.S.Rusev.
Elektro Prom.-st. & Priborostr. (Bulgaria), vol.18, no.1, p.17-19 (1983). In Bulgarian.
An expression for the driving torque of electromagnetic measuring mechanisms with printed coil is deduced. The efficiency of the most internal windings of the printed coil is evaluated. The obtained results are a basis for the design of mechanisms with optimum geometric configuration. (4 refs.)

64916 Measurement of the electrical conductivity of liquid metals by the eddy-current method. S.N.Zhuravlev, O.I.Ostrovskii, V.A.Grigoryan (Moscow Inst. of Steels & Alloys, Moscow, USSR).
High Temp. (USA), vol.20, no.4, p.551-5 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.665-70 (July-Aug. 1982). [received: April 1983]
A procedure is introduced for using the eddy-current method to investigate the electrical conductivity of metallic melts at high temperatures. The problems influencing the accuracy of the measurements are considered and ways of eliminating them are discussed. The measurement scheme and construction of the apparatus are described. Results are presented for measurements of the electrical resistance of liquid Fe, Co and Ni. The data obtained agree with the results of measurements by the rotating magnetic field method. (13 refs.)

64917 Measurements of high voltages by means of electron speed filtering. D.H.Kind, W.Lucas, D.Peier, B.Schulz (Phys. Tech. Bundesanstalt, Braunschweig, Germany).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.8-11 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
A cavity resonator is used as an electron speed filtering system. Discrete resonance values of the accelerating voltage can be calculated analytically. The device can, therefore, be used to build up a high-voltage scale with low uncertainty. Experimental investigations have shown good agreement with theory. Five current peaks generated by electrons which passed the resonator could be detected in the voltage range between 40 and 100 kV. They indicated a balanced condition of the electron speed filter, at which the accelerating voltages are calculable. These discrete voltages are nonequidistant, thus the measurement is unambiguous. Further developments are necessary and envisaged in order to considerably reduce the uncertainty. The goal is a measuring device using a superconducting niobium resonator which can be used to realize an absolute voltage scale up to 100-kV DC with a relative uncertainty of better than $\pm 10^{-5}$. (9 refs.)

64918 Contactless resistivity measurements under high pressure. B.Sundqvist, B.Lundberg (Dept. of Phys., Univ. of Umea, Umea, Sweden).
J. Phys. E (GB), vol.16, no.5, p.408-11 (May 1983).
For the first time, a contactless inductive method has been devised for measurements of the electrical conductivity of metallic materials under very high pressures (>1 GPa). A sample in the form of a thin disc is placed in a pick-up coil in a steady-state AC magnetic field. The output voltage from the coil is analysed with a lock-in amplifier to find the component due to eddy currents in the sample, from which the conductivity is calculated, using a semi-empirical expression. The influence of the steel pressure vessel is eliminated by making simultaneous measurements on a known reference material. Experimental results are shown for tin and sodium up to 1.3 GPa. (14 refs.)

64919 High-resolution probing of surface-charge distributions on electret samples. R.Gerhard-Multhaupt, W.Petry (Inst. for Electroacoustics, Tech,. Univ. of Darmstadt, Darmstadt, Germany).
J. Phys. E (GB), vol.16, no.5, p.418-20 (May 1983).
A scanning capacitive probe for the measurement of surface-charge distributions on electret foils is described. The resolution of the method is better than 100 μm, and surface potentials of up to 1.4 kV can be detected. Surface-charge patterns on corona-charged Teflon FEP electrets are given as examples. (14 refs.)

64920 Measurement of the conductivity of semiconductor disks in the SHF range. A.B.Davydov, N.I.Solin, G.L.Shtrapenin (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.666-8 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.95-6 (Aug. 1982). [received: April 1983]
The inhomogeneity of the superhigh frequency (SHF) field, occurring in semiconductor specimens, does not permit the application of quasistatic approximation for measuring ϵ' if the thickness of the specimen exceeds 0.3 k^{-1}. However, conductivity can be measured with an accuracy of 10-15% in specimens with thickness $d \lesssim k^{-1}$. The depolarization factor of the disk is ~30% larger than the depolarization factor of the ellipsoid of revolution in which the ratio of the axes is equal to the ratio of the thickness of the disk to its diameter. (7 refs.)

Progress in the realization of the units of capacitance, resistance, and inductance at the National Physical Laboratory, India .... See Entry 64875

On the measurement accuracy of the tissue permittivity in vivo .... See Entry 68993

07.55 MAGNETIC INSTRUMENTS AND TECHNIQUES

64921 Magnetic field effect measurements by time-selective absorption sampling. R.Treichel, H.Staerk, A.Weller (Abt. Spektroskopie, Max-Planck-Inst. fur Biophys. Chemie, Gottingen, Germany).

Appl. Phys. B (Germany), vol.B31, no.1, p.15-17 (May 1983).

An absorption method which permits time-selective measurements at different wavelengths has been developed in order to explore magnetic field effects on photoinduced electron transfer reactions in linked and unlinked donor-acceptor systems. (9 refs.)

64922 A capacitive instrument for the measurement of magnetostriction in pulsed fields. J.Heremans (Unite de Physico-Chimie et Phys. de l'Etat Solide, Univ. Catholique de Louvain, Louvain-le-Neuve, Belgium), J.-P.Michenaud, Y.Iye, N.Miura, G.Kido, K.Nakamura, S.Tanuma.

J. Phys. E (GB), vol.16, no.5, p.382-6 (May 1983).

The well known capacitive method for measuring small displacements has been widely used for magnetostriction measurements in steady or slowly varying magnetic fields. In pulsed fields this sensitive method cannot be used without severe precautions, owing to mechanical and electrical noises generated by the pulse. A special capacitive bridge instrument manageable in high pulsed fields is described. It has been successfully tested for measuring magnetostriction of bismuth up to 40T. (12 refs.)

64923 Magnetic-fluid density spectrometer with constant $(H^{\copyright})H$. V.Jusan, L.Homoradean (Inst. of Mines, Petrosani, Rumania).

Magnetohydrodynamics (USA), vol.18, no.3, p.325-9 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.133-6 (July-Sept. 1982). [received: April 1983]

Magnetic-fluid density spectrometers operate on the basis of the ability of nonmagnetic bodies immersed in a magnetic flu in a nonuniform magnetic field to seek the sites of minimum magnetic field intensity. Such devices offer several advantages over other devices, namely: they can operate continuously in high-yield production plants, they are inexpensive to build and require very small amounts of magnetic fluid, they are suitable for use in closed containers, and they do not require additional consumption of materials. Loss of magnetic fluid in a magnetic-fluid spectrometer can be completely eliminated by preliminary treatment of the mixture with a substance impermeable to the magnetic fluid. (4 refs.)

Ring core magnetometers at 200°C [oil well application] .... See Entry 69392

07.58 MAGNETIC RESONANCE SPECTROMETERS, AUXILIARY INSTRUMENTS AND TECHNIQUES

(see also 61.16N EPR and NMR determinations)

64924 Stimulated echo NMR spectra and their use for heteronuclear two-dimensional shift correlation. A.G.Redfield (Depts. of Phys. & Biochem., Brandeis Univ., Waltham, MA, USA).

Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.537-40 (22 April 1983).

NMR spectra are obtained from Fourier transformation of the latter part of a Hahn stimulated echo. The sequence is $90°\text{-}\tau_a\text{-}90°\text{-}\tau_b\text{-}90°\text{-}\tau_a$-digitize versus τ_2. This is demonstrated for transfer RNA in H_2O using the semiselective J&R pulse ($90°\text{-}\tau_p\text{-}90°$), developed by Plateau and Gueron in place of each 90° pulse. 2D correlation between ^{15}N and protons is obtained by applying a $90°\text{-}\tau_1\text{-}90°$ ^{15}N sequence during τ_b and ^{15}N decoupling while digitizing. The second Fourier transform is performed with respect to τ_1 after discarding the imaginary parts of the first transform, to obtain a real 2D map. Such a 2D spectrum has been obtained for 5 mM $^{15}NH_4Cl$ and several other small molecules. The sequence should be useful for studies of ^{15}N labeled macromolecules. (14 refs.)

64925 Sensitivity of V_2' saturation transfer electron paramagnetic resonance signals to anisotropic rotational diffusion with [^{15}N] nitroxide spin-labels. Effects of noncoincident magnetic and diffusion tensor principal axes. A.H.Beth, K.Balasubramanian (Depts. of Physiology & Chem., Vanderbilt Univ., Nashville, IN, USA), B.H.Robinson, L.R.Dalton, S.D.Venkataramu, J.H.Park.

J. Phys. Chem. (USA), vol.87, no.2, p.359-67 (20 Jan. 1983).

The authors examined the sensitivity of the widely employed second harmonic out-of-phase absorption EPR signal (V_2') recorded under conditions of partially saturating microwave and nonlinear Zeeman modulation fields to anisotropic Brownian rotational diffusion at X-(9.45 GHz) and K-band (22.0 GHz) microwave frequencies. [^{15}N,^2H] spin-labels were used in order to minimize computation times and provide high resolution of major and minor element spectral structurings. (22 refs.)

64926 Dynamical averaging of two symmetry-related magnetic resonance tensors in single crystals. S.K.Hoffmann, L.S.Szczepaniak (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).

J. Magn. Resonance (USA), vol.52, no.2, p.182-92 (April 1983).

Parameters of dynamically averaged EPR and NMR spectra are calculated. The formulae, relating averaged crystal tensor components and local molecular tensors for two identical resonance centers in crystals of C_2, C_{2h} or C_{2v} symmetry, are presented. The cases of the g^2 tensor in EPR spectra of Cu(II) ions and the quadrupole coupling gQq tensor in NMR of deuterons are discussed. (21 refs.)

64927 Obtaining high-fidelity spin 1/2 powder spectra in anisotropic media: phase-cycled Hahn Echo spectroscopy. M.Rance, R.A.Byrd (Div. of Biological Sci., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).

J. Magn. Resonance (USA), vol.52, no.2, p.221-40 (April 1983).

In the spectroscopy of isolated spin-1 nuclei in anisotropic media, the spectral distortion resulting from the inability to record the initial part of the free-induction decay was eliminated by using the quadrupolar echo technique. Wideline spin-1/2 spectroscopy is subject to the same problems associated with finite receiver recovery time as is spin-1 spectroscopy; however, these problems have been generally ignored in the past. Through the use of a very simple and well-known pulse sequence ($90°\text{-}\tau\text{-}180°$) the chemical shift interaction, among others, can be refocused to generate a so-called Hahn echo. If magnetic dipolar interactions with like nuclei and fluctuating interactions with other nuclei may be neglected, then the refocusing of the magnetization will be complete and an undistorted spin-1/2 powder spectrum can be obtained by Fourier transforming the signal starting at the peak of the echo. The practical aspects of implementing the Hahn echo technique are discussed. A phase-cycling scheme is proposed to prevent spectral distortion due to misset pulse lengths. The effects of finite pulse lengths are investigated, and the theoretical single pulse and echo distortion factors are demonstrated to differ from those which were determined for quadrupolar echo spectroscopy. Experimental verification of some of the theoretical predictions is provided. (21 refs.)

64928 Nuclear magnetic resonance flip-angle effects: observability of multipole operators. L.Werbelow (Dept. of Chem., New Mexico Inst. of Mining & Technol., Socorro, NM, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.282-7 (April 1983).

General FTNMR sampling-pulse flip-angle dependences of diagonal multipole operators are derived and discussed. Although the FT sampling pulse does not mix multipoles of different rank, each multipole is characterized by a unique flip angle where the intensity of this multipole is rendered unobservable. The simple expressions presented are equally valid for multipolar spin systems or multiply degenerate, multispin dipolar, or quadrupolar systems. (10 refs.)

64929 A simple method for simultaneous homo- and heteronuclear decoupling on FT-NMR spectrometers. R.Nunlist, J.D.Arenivar (Dept. of Chem., Univ. of California, Berkeley, CA, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.305-7 (April 1983).

Analysis of complex spectra relies on a variety of decoupling experiments designed to simplify the observed resonances into interpretable pieces of the total spin system. Nuclei other than protons usually lead to simple noise-decoupled spectra due to the large chemical shifts of the observed lines. However, increasing sophistication of molecules having complex heteronuclear spectra requires similar techniques for simplifying the observed lines. Some efforts have been made to analyze these systems using two-dimensional J spectra, but the large coupling constant range, long T_1 relaxation times, and data storage and computing requirements make this experiment inconvenient. The authors have developed a 'triple-resonance' experiment combining proton broadband decoupling with selective homonuclear decoupling for use with standard FT-NMR spectrometers. (4 refs.)

64930 Fast and economical treatment of 2D NMR data. A.G.Redfield (Dept. of Phys. & Biochem., Brandeis Univ., Waltham, MA, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.310-12 (April 1983).

The author was faced with the desire to do 2D FT with limited and slow mass storage, namely, a single LINCTAPE magnetic tape unit (similar to DECTAPE) with about 300-kbyte capacity. While this represents an unusual problem, its solution may be of interest to others. He can now do 2D FT runs (75000 output points maximum limited by the tape capacity) in which about 20% of the run is wasted waiting for tape storage and rewinding, and in which a substantial portion of the output map (about 16000 points) can be read out and processed in about 2 minutes. Currently he has only a sequential one-dimensional display of the two-dimensional spectrum; an intensity display would require no extra time but of course calculation of a contour display would require time. If implemented on a disk, the processing times would be negligible. (4 refs.)

64931 A broadband radiofrequency reflected-wave detector and its application to a nuclear magnetic resonance spectrometer. R.W.Dykstra (Union Carbide Corp., South Charleston, WV, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.313-17 (April 1983).

Intense radiofrequency (RF) magnetic fields for proton decoupling and sensitivity enhancement techniques and high-speed sample rotation are basic features of nuclear magnetic resonance spectrometers used for studies of solids. Due to the higher RF power requirement for solid-state NMR (up to several kilowatts) compared to the typical RF power used for liquid-phase samples (40 to 100 W), some conditions which create a nuisance when acquiring liquid-phase spectra (a broken sample tube in the probe or high humidity which can upset a low-temperature experiment) can result in a catastrophic failure. Poor cable connections, faulty cables, dielectric breakdown (arcing) resulting from high humidity in the NMR probe in the presence of the high-voltage RF excitation pulse, and disintegration of the sample rotor due to forces caused by high rotation rates are some of the conditions that may be expected in normal use and will cause adverse effects in the RF transmission path. A circuit which detects an increase in the amplitude of an RF reflected wave is reported. The circuit is usable from 10 to 500 MHz and has a built-in capability which allows the user to preset a variable threshold over a range from 50 mW to 100 W. (11 refs.)

64932 Frequency versus field modulation in magnetic resonance. A.Dulcic, B.Rakvin (Ruder Boskovic Inst., Univ. of Zagreb, Zagreb, Yugoslavia).

J. Magn. Resonance (USA), vol.52, no.2, p.323-5 (April 1983).

Modulation is a very important technique in magnetic resonance experiments. It is generally used to improve sensitivity. Modulation effects can also be used to extract relaxation parameters from the experimental data. Depending on the type of modulation, the effects can be nontrivial so that a better knowledge of the processes involved may lead to new applications. Recently, Kim (1982) analyzed the production of sideband and harmonic structure in the observed signal under conditions of frequency and field modulation. His findings are in contradiction with the classical review article on modulation effects in magnetic resonance by Haworth and Richards (1966). In view of the modulation technique the authors attempt to resolve that controversy. (6 refs.)

64933 Heteronuclear zero quantum spectroscopy as a conformational probe. P.H.Bolton (Chem. Dept., Wesleyan Univ., Middletown, CT, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.326-9 (April 1983).

Investigations of the conformations of molecules in liquids are often aided by the information present in the proton NMR spectrum of the sample. The proton chemical shifts and proton-proton couplings often contain sufficient information for determination of the structural features of interest. However, in many cases the proton spectrum is obscured by the signals from solvent or an enzyme or by overlap of signals from the molecule being studied. One approach to overcoming this problem is to use heteronuclear two-dimensional NMR to detect indirectly the proton spectral information. The heteronuclear two-dimensional NMR method can be used to obtain proton spectra of sufficient quality to answer conformational questions. Another approach to spying on protons is to use heteronuclear multiple quantum spectroscopy. Since indirect detection of protons is of use in examining the conformations and structures of molecules where conventional approaches fail, it was of interest to begin an investigation of the merits of multiple quantum spectroscopy relative to heteronuclear two-dimensional NMR. Zero quantum spectroscopy, in particular, appears to be quite promising. The linewidths obtained in the crucial domain containing the proton information are only weakly dependent on the field homogeneity. A more advantageous feature is that the proton spectra obtained via heteronuclear zero quantum spectroscopy correspond to the heteronuclear decoupled proton spectrum when only one proton is coupled to the heteronucleus. (12 refs.)

64934 Determination of heteronuclear coupling constants via semiselective two-dimensional J spectroscopy. A.Bax (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.330-4 (April 1983).

The use of the original 2D J-spectroscopy experiments for the exact determination of coupling constants requires a very fine digitization along the F_1 frequency axis; this leads to a very large size of the required data matrix, unless the acquisition time along the t_2 axis is made very short, which in turn decreases the sensitivity of the experiment dramatically. The intensity of a certain carbon-13 nucleus in this high-F_1-resolution application will generally be spread over a large number of multiplet components, which decreases the sensitivity even further. All problems mentioned above can be overcome by using a modified version of the proton-flip experiment in which only one proton is 'flipped' by the proton pulse (which in this case is selective) in the center of the evolution period. The author describes two experiments which rely on the same principle as the selective proton-flip experiment and which allow the accurate determination of either all direct ^{1}H-^{13}C coupling constants by removal of the long-range splittings or the determination of all long-range couplings while removing all the direct ^{1}H-^{13}C splittings. (16 refs.)

64935 An improved sequence for broadband decoupling: WALTZ-16. A.J.Shaka, J.Keeler, T.Frenkiel, R.Freeman (Phys. Chem. Lab., Oxford Univ., Oxford, England).
J. Magn. Resonance (USA), vol.52, no.2, p.335-8 (April 1983).
The principal criteria for decoupling performance are (a) wide effective proton bandwidth for a given power dissipation, (b) residual splittings of carbon-13 small compared with the line width, (c) insensitivity to pulse length error or B_2 inhomogeneity, (d) insensitivity to errors in the radiofrequency phase shifts, (e) negligible sidebands due to sampling within the decoupling cycle, and (f) programming simplicity. With these criteria in mind, a search was made for better decoupling sequences, using computer simulation to predict the residual splitting as a function of proton resonance offset. The culmination of this search was a new spin inversion sequence. (10 refs.)

64936 Improvement in the cross-polarization NMR experiment for suppression of rigid protonated carbons. P.Dubois Murphy (Magnetic Resonance Group, IBM Instruments Inc., Danbury, CT, USA).
J. Magn. Resonance (USA), vol.52, no.2, p.343-5 (April 1983).
A very useful NMR experiment for solids simply requires the use of a calculated delay for the decoupling pulse. For a proper choice of the decoupler delay T_D, singly or doubly protonated carbons can usually be suppressed from the carbon-13 NMR spectrum. Owing to their usually rapid motion at room temperatures, triply protonated carbons (methyl groups) are usually not suppressed as easily. This experiment has received varius titles such as 'dipolar dephasing' or 'interrupted decoupler'. One problem with this experiment is that the decoupler delay time T_D introduces an additional linear phase error in the observed NMR spectrum if the signal digitizer is triggered at the end of the delay. Alternately, if the digitization is begun prior to the delay, the additional linear phase error can be avoided at the expense of possibly recording (1) the would-be suppressed carbon signals and (2) an RF transient when the decoupler pulse is activated. If a chemical-shift refocusing pulse is added to the rare-spin pulse sequence at the center of the decoupler delay T_D, then the digitization can begin at the end of the delay without the undesired linear phase error. (7 refs.)

64937 Pulsed microwave microwave double resonance spectroscopy with Fourier transform technique. G.Bestmann, H.Dreizler (Abteilung Chem. Phys., Univ. Kiel, Kiel, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.452-8 (April 1983).
Presents a new three and four level double resonance spectroscopy in the microwave region. A pulsed pump radiation and Fourier transform technique for detection of the signal radiation is used. This method is complementary to that using continuous microwave pump radiation. (5 refs.)

Exact interpolation of Fourier transform spectra .... See Entry 64954

Change in Fourier spectrometer aperture in interferogram recording .... See Entry 64959

Interpretation of lanthanide-induced shifts in NMR spectra. The case of nonaxial symmetry .... See Entry 66017

Calculation of transverse relaxation times from lineshapes modified by Gaussian-exponential filtering .... See Entry 66022

Multiplet selection using multiple quantum coherence .... See Entry 66026

Rotating nulear demagnetization refrigerator for experiments on superfluid He^3 .... See Entry 67299

Resolution of transient NMR experiments in the rotating coordinate system in solids .... See Entry 68054

Quantitative determination of catalytic surface adsorption sites by Fourier transform infrared photoacoustic spectroscopy .... See Entry 68815

NMR studies of perfused cells .... See Entry 68934

07.60 OPTICAL INSTRUMENTS AND TECHNIQUES

(for radiation detection, see 07.62; for spectroscopy and spectrometers, see 07.65; for holography, see 42.40; for optical sources and standards, see 42.72; for optical lens and mirror systems, see 42.78; for optical devices, techniques and applications, see 42.80; for optical testing and workshop techniques, see 42.85; for radiation spectrometers and spectroscopic techniques, see 29.30; for radiation measurement, detection and counting, see 29.70)

64938 Optical profilometer in white light. C.Gorecki, G.Tribillon (Lab. de Phys. Generale et Optique Faculte des Sci. et des Tech., Besancon, France), J.Mignot.
J. Opt. (France), vol.14, no.1, p.19-23 (Jan.-Feb. 1983).
Recently optical methods for roughness measurement have been developed. However, most of them only enable the usual criteria Ra and Rt to be determined. A method is presented based upon the defocusing of a white light beam. This method enables one to determine any statistical parameters, profiles or 3D images of the surface being measured. Results obtained are compared with those determined with a technical stylus for samples of various roughness. (9 refs.)

64939 Accuracy of an optical open area ratiometer. F.M.Dickey, B.W.Jones (Boeing Military Airplane Co., Wichita, KS, USA).
Opt. Eng. (USA), vol.22, no.2, p.275 (March-April 1983).
An optical open area ratiometer for measuring the percent open area of perforated sheet materials has been developed. The devices uses a technique based on Fourier optics in which a detector is employed to measure a small central portion of the light in the Fraunhofer diffraction pattern of the perforated sheet. This paper discusses the associated problems and results of testing the accuracy of the device. The accuracy is shown to be on the order of 2% of the open area ratio. (1 ref.)

64940 A study of geometrical factor in optical particle counters. C.Singh, R.N.Singh, P.K.C.Pillai (Phys. Dept., Indian Inst. of Technol., New Delhi, India), N.Nath, S.K.Chattopadhyaya.
Opt. Appl. (Poland), vol.12, no.2, p.231-42 (1982).
The variation of the geometrical factor for various geometries of illumination and collection optical systems in optical particle counters has been studied. (12 refs.)

Remarks about calibration of automatic analyser of aerosols . See Entry 64883

An optical probe for interface detection at high pressure (180 bar) and high temperature (360°C) [two-phase flow] .... See Entry 65562

A monocular camera based measurement system using the thin lens approximation .... See Entry 66369

Self-calibrating surface measuring machine .... See Entry 66414

Optical heterodyne measurement of vibration phase .... See Entry 66527

07.60D Photometry and radiometry

(inc. colorimetry; see also 07.62 Detection of radiation)

64941 Processor controlled multichannel microdensitometry for gas electron diffraction patterns. D.W.Paul, J.D.Ewbank, O.J.Benston, L.Schafer (Dept. of Chem., Univ. of Arkansas, Fayetteville, AR, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.127-30 (March-April 1983).
The design of a novel type of densitometer for evaluating photographic plates from gas electron diffraction is described. A commercially available linear diode array has been interfaced to a PDP-11/23 minicomputer via the DRV11 parallel interface. The diffraction pattern from a photographic plate is optically focused onto a solid state linear photodiode array. The position of each diode in the array provides the radial location information and the radial intensity of each diode is digitized with 14-bit resolution. The instrument allows for faster data recording since the total pattern is determined in one scanning measurement. (22 refs.)

Silicon detector nonlinearity and related effects .... See Entry 64952

Microcomputer controlled flash photometry with submicrosecond resolution and Raman spectroscopy .... See Entry 64955

A colorimetric determination of residual thiosulfate (hypo) in processed paper .... See Entry 64976

A simple method for measuring the noise of amplifying foils .. See Entry 65002

Substrate parameter determination for thin film spectrophotometric measurement correction .... See Entry 68339

Visualization of the results of flaw detection on a color-television screen .... See Entry 68744

Spatial and radiometric resolution of the Landsat-3 RBV system .... See Entry 69474

Star transits with a photoelectric micrometer applied to the transit instrument of Torino Observatory .... See Entry 69501

Infrared camera for ten micrometer astronomy .... See Entry 69506

07.60F Polarimetry and ellipsometry

64942 Ellipsometric studies of rough silicon surfaces. R.B.Bendere, R.P.Kalnynya, I.A.Feltyn.
Opt. & Spectrosc. (USA), vol.53, no.3, p.299-301 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.507-11 (Sept. 1982). [received: May 1983]
The possibility of ellipsometric determination of the parameters of microroughnesses of rough silicon surfaces was examined. It was shown on the basis of investigations of rough surfaces of two types that with an established form of roughness ellipsometric methods give results agreeing well with microscopic investigations. To determine the type of roughness the use of immersion ellipsometry is proposed. (7 refs.)

The design of polarimeters for astronomy .... See Entry 69504

07.60H Refractometry and reflectometry

64943 Refractive-index measurement of bulk materials: prism coupling method. H.Onodera, I.Awai, J.Ikenoue (Electronics Dept., Kyoto Univ., Kyoto, Japan).
Appl. Opt. (USA), vol.22, no.8, p.1194-7 (15 April 1983).
A simple method of measuring refractive indices of bulk materials using a prism coupling procedure is described. Refractive indices are determined from the measurement of the angle incident to the prism at which total reflection on the prism base breaks. This method is shown to possess the advantages of its simple procedure and sample preparation. The accuracy is comparable with that of minimum deviation method if the prism is well calibrated. Experimental results for several materials are given with an evaluation of possible errors. (4 refs.)

64944 Simple method for measuring the refractive index of a liquid or glass wedge. M.V.R.K.Murty (Centro de Investigaciones en Optica AC, Leon, Mexico), R.P.Shukla.
Opt. Eng. (USA), vol.22, no.2, p.227-30 (March-April 1983).
Describes a simple method of measuring the refractive index of a liquid. The basic element is a thin wedge cell, and the source of light is a low power He-Ne laser. Conditions are derived to obtain the best possible accuracy using this setup. The same setup can also be used for the determination of the refractive index of a solid medium such as glass. (2 refs.)

Specification and tolerancing of reflective test systems for IR and visible use .... See Entry 66370

07.60L Interferometry

64945 Double-pass oblique-incidence interferometer for the inspection of nonoptical surfaces. I.J.Wilson (CSIRO Div. of Chem. Phys., Clayton, Victoria, Australia).
Appl. Opt. (USA), vol.22, no.8, p.1144-8 (15 April 1983).
Interferometric testing of the flatness or straightness of ground surfaces of metals, granite, ceramics, and glasses has always proved difficult because of the extremely low specular reflection from these optically rough surfaces. At oblique angles of incidence the specular reflection coefficient of nonoptical surfaces increases rapidly, typically from near 0.01 at 75° up to, say, 0.50 at 85° and near 1.00 at 90° angle of incidence. By taking advantage of this enhanced reflection at oblique incidence and the brightness and spatial coherence of visible gas lasers, it becomes practical to use interferometric inspection of nonoptical surfaces. A novel double-pass oblique-incidence interfe-

rometer is described which enables testing of large pieces having a specular reflection as low as 1%. (4 refs.)

64946 A moire fringe alignment aid. G.T.Reid (Nat. Engng. Lab., Glasgow, Scotland).
Opt. & Lasers Eng. (GB), vol.4, no.2, p.121-6 (1983).
The task of accurately superimposing two photographic transparencies is frequently encountered in some areas of optical metrology. By recording a suitable line structure, along with the image on each photograph, moire fringes formed when two of the structures are superimposed can be used to give an accurate indication of the alignment of the transparencies. (5 refs.)

64947 Moire quasi-interferometry. L.Liu (Univ. Oldenburg, Oldenburg, Germany).
Opt. Commun. (Netherlands), vol.45, no.4, p.215-20 (15 April 1983).
Two kinds of moire techniques with double exposures in quasi-interferometry are developed. In the form of moire fringes, one method is for measuring the change of the phase gradient in the test object and another to obtain higher-order phase derivatives. Theoretical analyses and experiments about some interesting applications are given. (10 refs.)

64948 Comparative analysis of optical characteristics of double-beam and multiple-beam selective interferometers. A.I.Lopatin, A.V.Laletin.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.472-5 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.4-6 (Aug. 1982). [received: April 1983]
Formulas are given that describe the transmittance of a multiple-beam selective interferometer ignoring losses. The relationship between its basic optical characteristics and the reflectivity of the diffraction gratings used is shown. The described instrument is compared with a double-beam SISAM and a Fabry-Perot interferometer. (3 refs.)

Real-time longitudinal displacement analysis of rough surfaces by observing fringes within objective laser speckles .... See Entry 64881

A generalized speckle interferometry method for measuring the arbitrarily oriented (small) displacements of a rigid body .... See Entry 64884

Effects of speckle recording on the diffraction halo in speckle photographs .... See Entry 64984

Holographic interferometer for testing aspheric molds and molded parts .... See Entry 66234

Laser optical components for machine tool and other calibrations .... See Entry 66317

Evaluation of wave aberrations of objectives. III. Analysis of lateral shearing interferograms. Experimental results .... See Entry 66363

Testing the quality of the operating surface of a parabolic devitrified glass astronomical mirror .... See Entry 66366

Boresighting collimators using laser unequal path interferometry .... See Entry 66375

Integrated optics wave front measurement sensor .... See Entry 66409

Interferometric countercheck in precision cementing .... See Entry 66412

Self-calibrating surface measuring machine .... See Entry 66414

Displacement measurements around cracks in three-dimensional problems by a hybrid experimental technique .... See Entry 66512

Interferometric analysis for small rotation .... See Entry 66528

Experimental study of inelastic strain patterns in a model of a tube-plate ligament using an interferometric moire technique .... See Entry 66529

On stress analysis of anisotropic composites through transmission optical patterns: isochromatics and isopachics .... See Entry 66532

A method of three-dimensional strain measurement on non-ideal objects using holographic interferometry .... See Entry 66533

Detection of the Faraday rotation produced by a gas inside a Michelson interferometer .... See Entry 66671

Limitation of the accuracy of interferometrically measured electron density profiles of laser-produced plasmas .... See Entry 66748

Edge effects in composites by moire interferometry .... See Entry 68703

A holographic surface measurement of the Texas 4.9-m antenna at 86 GHz [space applications] .... See Entry 69507

07.60P Optical microscopy

64949 Theoretical studies on optical coherent microscopes. J.J.Clair, A.M.Hamed (Ecole Nat. Superieure de l'Electronique et de ses Applications, Cergy, France).
Optik (Germany), vol.64, no.2, p.133-41 (May 1983).
Presents a theoretical analysis of the confocal coherent microscope. The authors have calculated the total impulse response for two symmetric pupils having a conic amplitude distribution, and analytic formulae are given. Also, calculations are made using combinations of different shapes for the collector and objective lenses, and the image for a point object is calculated in all cases which shows that further improvement in resolution can be attained by using pupils of conic and annular amplitude distribution for the objective and collector lenses of the coherent microscope. Finally, the authors analyse a spatially coherent microscope for the purpose of processing microscopic information. (14 refs.)

64950 Optical microscopy with extended depth of field. C.J.R.Sheppard, D.K.Hamilton, I.J.Cox (Dept. of Engng. Sci., Univ. of Oxford, Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.171-86 (8 May 1983).
A method is described that allows the depth of field in optical microscopy to be extended, in principle without limit, while high-resolution, diffraction-limited imaging is retained. Experimentally, an extension of more than two orders of magnitude has been achieved. The images are found to be of high optical quality, and this is borne out by theoretical predictions. The resolution is shown theoretically to be similar to that in a conventional microscope of the same numerical aperture, and for some criteria an improvement is obtained. (11 refs.)

64951 Observation of a photoionic image in a laser desorption microscope. V.S.Letokhov, V.S.Likhachev, V.G.Movshev, S.V.Chekalin (Inst. of Spectroscopy, Acad. of Sci., Troitsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1377-8 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2117-18 (Nov. 1982). [received: May 1983]
A magnified photoionic image of a target irradiated with ultrashort laser pulses of different wavelengths was observed with the aid of a laser desorption microscope. (4 refs.)

Adapting microscopes for instant photomicrography .... See Entry 64978

Specification and tolerancing of reflective test systems for IR and visible use .... See Entry 66370

07.62 DETECTION OF RADIATION (BOLOMETERS, PHOTOELECTRIC CELLS, I.R. AND SUBMILLIMETRE WAVES DETECTION)

64952 Silicon detector nonlinearity and related effects. A.R.Schaefer, E.F.Zalewski, J.Geist (Radiometric Phys. Div., US NBS, Washington, DC, USA).
Appl. Opt. (USA), vol.22, no.8, p.1232-6 (15 April 1983).
An explanation is put forth for the observed nonlinearity in the red spectral region of the response of silicon photodiodes. Experiments are described to support the explanation; and the results, implications, and precautions indicated for the use of these diodes are given. Correlation of nonlinearity with spatial nonuniformity of response is demonstrated. (10 refs.)

64953 Calculation of fast-response low-temperature bolometers on a solid substrate. I.A.Khrebtov.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.469-72 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.1-4 (Aug. 1982). [received: April 1983]
The temperature sensitivity of fast-response low-temperature bolometers on a solid substrate is calculated by the electrothermal analogy method with the boundary thermal resistance taken into account. The character of the variation of the bolometer sensitivity is analyzed in the frequency interval $\omega = 10^{-2}$-10^{-8} rad^{-1} and in the 1-300K temperature region for different combinations of materials for the heat insulating interlayer and base and for different geometrical dimensions of these structures. (7 refs.)

General method of calculating self-consistent calibration curves for optical pyrometers .... See Entry 64908

Spectral responses of the n-PbTe/p-Pb$_{1-x}$Sn$_x$Te heterojunctions .... See Entry 67761

Star transits with a photoelectric micrometer applied to the transit instrument of Torino Observatory .... See Entry 69501

Infrared camera for ten micrometer astronomy .... See Entry 69506

07.65 OPTICAL SPECTROSCOPY AND SPECTROMETERS

(inc. photoacoustic spectroscopy)

64954 Exact interpolation of Fourier transform spectra. C.Giancaspro, M.B.Comisarow (Dept. of Chem., Univ. of British Columbia, Vancouver, British Columbia, Canada).
Appl. Spectrosc. (USA), vol.37, no.2, p.153-66 (March-April 1983).
A systematic study of interpolation of Fourier transform (FT) spectra is reported. Interpolation errors are examined for both frequency determination and intensity determination for different interpolation procedures for both absorption mode and magnitude mode FT spectra. The errors are presented in both analytical and graphical form as functions of the number of zero-fillings and (T/τ), the ratio of the acquisition time to the relaxation time of the time domain signal. (29 refs.)

64955 Microcomputer controlled flash photometry with submicrosecond resolution and Raman spectroscopy. Z.Meiri, Y.Berezin, A.Shemesh, B.Ehrenberg (Dept. of Phys., Bar-Ilan Univ., Ramat-Gan, Israel).
Appl. Spectrosc. (USA), vol.37, no.2, p.203-7 (March-April 1983).
The interfacing of two spectrophotometric systems to an Apple II microcomputer is described. The first is a flash photometric setup in which light flashes are formed either with a chopper wheel, or with an acousto-optic modulator which is activated by the microcomputer. Spectroscopic transients are monitored with a time resolution as short as 250 ns, by counting photon pulses into the computer's memory in the fast direct memory access mode. A microcomputer-controlled Raman spectrometer, in which the Apple II is interfaced to a Spex monochromator and the photon counting electronics, is also described. (9 refs.)

64956 Reflecting Schmidt imaging spectrometers. J.B.Breckinridge, N.A.Page (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA), R.R.Shannon, J.M.Rodgers.
Appl. Opt. (USA), vol.22, no.8, p.1175-80 (15 April 1983).
A new very wide angle imaging spectrometer optical configuration which uses an all-reflecting Schmidt camera with a prism spectrometer to give a strip field of view is presented. Three complete systems (15°, 8.5°, 2.6° FOV), including fore optics and spectrometer optics, were designed. These slit fields of view are pushbroomed across object space to create a 2-D image. The performance of each near diffraction-limited system and optical prescriptions is detailed. An all-reflecting Schmidt camera fore-optics system with a 60° field of view is also given. (15 refs.)

64957 Polarization spectroscopy of gaseous media by the photon-echo method. I.V.Evseev (Moscow Engng. Phys. Inst., Moscow, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.614-19 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.182-7 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The photon echo phenomenon has been transformed in recent years into one of the most effective methods in nonlinear laser spectroscopy. It can be used to identify the corresponding resonance transitions, and also to obtain experimental data on the relaxation properties of resonance transitions and levels. Polarization spectroscopy of gaseous media by the photon-echo technique, i.e. the study of the polarization properties of the photon echo and of its different varieties, appears to be particularly promising. This is so because polarization measurements are more accurate than intensity measurements, since they are not affected by possible fluctuations in the intensities of the light pulses exciting the medium. (56 refs.)

64958 A realtime ruby luminescence spectrometer for pressure determinations. K.R.Hirsch, W.B.Holzapfel (Experimentalphys. Univ. GH-Paderborn, Paderborn, Germany).
J. Phys. E (GB), vol.16, no.5, p.412-17 (May 1983).
A design of a spectrometer system with a fixed self-focusing grating and a linear diode array (Reticon 512G) is described, where a microprocessor directly evaluates the pressure in realtime from ruby luminescence spectra at a typical repetition rate of 2 scans per second and a precision of better than ±0.025 GPa over a range of nearly 50 GPa. A self-calibration procedure allows for reliability tests of the instrument at any time. As an application a time-resolved isochoric study of the pressure behaviour at the phase boundary between ice VI and the liquid is shown. (6 refs.)

64959 Change in Fourier spectrometer aperture in interferogram recording. B.N.Grechushnikov, G.V.Vladimirtsev, S.V.Koryshev.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.760-2 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.38-41 (July 1982). [received: March 1983]
Ways are considered of recording and processing patterns measured with a Fourier spectrometer with a varying aperture and estimates given of the possible gain in the signal-to-noise ratio. (3 refs.)

64960 Measurement of absorption coefficients of highly transparent solids by emission spectroscopy. A.V.Vasil'ev, E.M.Dianov, V.G.Plotnichenko.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.820-3 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.112-16 (July 1982). [received: March 1983]
In the described method the emission spectrum I_λ of the specimen is investigated instead of the transmission spectrum T_λ, and the absorption coefficients of the specimen can be calculated from an analysis of the emission spectrum. (7 refs.)

64961 Time resolved high resolution spectroscopy using the high frequency deflection technique and supersonic jet targets. I. Instrumental; simplification of spectra; reductions of collisional quenching. P.Erman, O.Gustafsson, M.Larsson (Dept. of Phys., Royal Inst. of Technol., Stockholm, Sweden).
Phys. Scr. (Sweden), vol.27, no.3, p.192-200 (March 1983).
A supersonic jet gas target arrangement has been designed and tested in high resolution lifetime measurements using the high frequency deflection technique. Rotational temperatures down to 15K are obtained at target pressures up to 1 torr and a hundredfold decrease of distortions due to collisional quenching is observed as compared to ordinary static gas targets. These improvements enable registrations of almost rotationless molecular spectra at high intensities without collisional quenching which greatly extend the versatility of this time resolved technique. (24 refs.)

64962 The scope for applying image converter in spectroscopy. V.Kapicka, Z.Ondracek (J.E. Purkyne Univ. Brno, Brno, Czechoslovakia).
Scr. Fac. Sci. Nat. Univ. Purkynianae Brunensis Phys. (Czechoslovakia), vol.12, no.9, p.431-4 (1982). In German.
Brief details of the RCA image converter, type 4550 are given, and results of measurements of intensities of spectrum lines and afterglow effects are considered. The sensitivity of photodiodes and transistors to IR region indicates the limitation when wide spectra are to be analysed. (2 refs.) *I.G.*

Light echo in gases .... See Entry 66348

Spectroscopic Doppler-free methods for measuring the electric and magnetic fiels in magnetically insulated ion diodes .... See Entry 66758

Substrate parameter determination for thin film spectrophotometric measurement correction .... See Entry 68339

A spectroscopic method of determination of the perfection of the crystal structure of the surface of silicon sheets .... See Entry 68712

Multiplex methods in atomic spectroscopy .... See Entry 68814

07.65E UV and visible spectroscopy and spectrometers

64963 Electret microphone for use in photoacoustic spectrometer and photoacoustic spectrum of some rare earth oxide powders. V.N.Rai, L.B.Tiwari, S.N.Thakur, D.K.Rai (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Pramana (India), vol.19, no.6, p.579-92 (Dec. 1982). [received: April 1983]
Describes a new method for the polarisation of an electret foil which has proved very convenient and yields a foil having very good performance in a microphone. The variations in the charge accumulation on the electret foil and its decay with time as well as the variation of the microphone sensitivity with different microphone parameters has been investigated. The sensitivity of the home-made microphone is estimated as 1 mV/μbar. The working of this type of microphone and its comparison with a commercial microphone as used in a single beam photoacoustic spectrometer is discussed. A brief description of the photoacoustic spectrometer including microphone biasing and the photoacoustic cell is given. The photoacoustic spectra of some rare earth oxides in the form of powders have been recorded. It is seen that the atomic levels of triplyionised rare earths which are not fluorescent appear very prominently in the photoacoustic spectrum. The spectra for terbium and praseodymium oxides do not show clear peaks probably due to the presence of different stoichiometric forms. (21 refs.)

Long path length samples in thermal lens calorimetry .... See Entry 64905

07.65G IR spectroscopy and spectrometers

64964 Wavenumber calibration of Fourier transform spectra. R.L.Hawkins, M.L.Hoke, J.H.Shaw (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.134-9 (March-April 1983).
Spectra with a resolution of about 0.06 cm^{-1} obtained by a Fourier transform spectrometer have been calibrated by the internal standard method. An accuracy of 3×10^{-3} cm^{-1} over intervals of several thousand wavenumbers has been obtained by measuring the lines with a precision of 2×10^{-3} cm^{-1} and by using a large number of standard lines. (19 refs.)

64965 Width-enhanced binary representation for library searching of vapor phase infrared spectra. F.V.Warren,Jr., M.F.Delaney (Dept. of Chem., Boston Univ., Boston, MA, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.172-81 (March-April 1983).
A method is presented for the representation of vapor phase infrared spectra in a binary format which preserves both width and position information about each peak. Preselection of an optimally width-enhanced library of binary spectra, in advance of any actual library searching, is approached through the application of information theory and Grotch's method for prediction of matching histograms. A direct comparison of library searching results is conducted to complement the preselection efforts. The applicability of a channel-combination approach based on information theory is demonstrated. (28 refs.)

64966 Inverse Lamb dip spectroscopy using microwave modulation sidebands of CO_2 laser lines. G.Magerl, J.M.Frye, W.A.Kreiner, T.Oka (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.656-8 (15 April 1983).
The authors report the observation of infrared Lamb dips using a widely tunable laser source. The microwave sidebands generated on CO_2 laser lines provide sufficient power ($\sim$0.5 mW) and spectral purity ($\Delta\nu\lesssim100$ kHz) for saturation spectroscopy. Application of this infrared source to the observation of infrared Lamb dip spectra of CH_3F and SiF_4 is reported. (18 refs.)

64967 Infrared investigations with high sensitivity spectrometers: aspects of modern research. K.Narahari Rao (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.659-66 (Nov. 1982). [received: April 1983]
The author discusses the modern aspects of infrared investigations with high sensitivity spectrometers. Experiments with solid hydrogen are reviewed. (5 refs.)

Quantitative determination of catalytic surface adsorption sites by Fourier transform infrared photoacoustic spectroscopy .... See Entry 68815

Fourier transform infrared evolved gas analysis (FT-IR-EGA) .... See Entry 68816

07.68 PHOTOGRAPHY, PHOTOGRAPHIC INSTRUMENTS AND TECHNIQUES

(for light sensitive materials see also 42.70)

64968 Canon T50. A report. G.Crawley.
Br. J. Photogr. (GB), vol.130, no.11, p.289-91 (18 March 1983).
Describes the Canon T50, a fully automatic programmed exposure control, 35 mm SLR with built in motor winder. The camera is not aimed at the professional market but is an attempt to bridge the gap between the all-in package and sophisticated SLR camera, offering many of the attractions of the former combined with the greater versatility inherent in a 35 mm SLR with interchangeable lenses. Following a brief outline of the main features, i.e. size, weight, shape, finish and top plate layout, the author gives operational details for the exposure control, electrical components, viewfinder, shutter, film advance and flash. (no refs.)

64969 Photography using semiconductors.
Funk-Tech. (Germany), vol.38, no.3, p.110-12 (March 1983). In German.
The essential components of semiconductor image converters, such as charge coupled devices, are discussed. The architecture of such CCDs for photographic cameras is described, e.g. frame transfer arrays, interline transfer arrays and charge injection devices. (no refs.) *A.E.W.*

64970 Highlights from 'Photokina'. G.Tollmein.
Funk-Tech. (Germany), vol.38, no.3, p.116-17 (March 1983). In German.
The latest developments in photographic technology as shown at 'Photokina' in Cologne are discussed, and in particular the growing convergence of TV, video and radio technologies. A range of microimage cameras from Kodak, Minolta and Rollei are reviewed. (no refs.) *A.E.W.*

64971 Light barrier as photo-trap: with the camera on safari. K.Hantke.
Funkschau (Germany), no.6, p.84-8 (18 March 1983). In German.
The construction and use of an ingenious high-performance flash unit as an aid in the photography of shy nocturnal animals are described in detail, supported by the complete circuit diagram, pulse waveforms, components list and drawings of the two printed boards with layout instructions. The system contains an infrared sender pulsed at a 10 kHz rate, and a receiver with a BP 104 light diode as input sensor, made particularly efficient by the fitting of a beam finder, an object-recognizing electronic 'window' equivalent to approximately 40 μs and a complex chain of trigger pulses to initiate the shutter and optionally up to three electronic flashes at selected time intervals. 9 ICs are used, plus a number of discrete diodes, transistors and thyristors. Mains or battery supply is possible. (no refs.) *A.L.*

64972 Physical behaviour of a magnetic one-component developer. M.Schleusener, R.Mugai (VEB Mikroelektron., Berlin, Germany), M.Lammerzahl, E.Ellinger, H.-W.Stottmeister, H.Fiedler.
J. Signalaufzeichnungsmater. (Germany), vol.11, no.1, p.47-54 (1983). In German.
The electric and magnetic properties of two different one component magnetic developers are measured and their deposition behaviour is investigated quantitatively. The experimental results, relating to the toner parameters and toner deposition are discussed on the basis of physical principles of the deposition mechanism. (8 refs.)

64973 Model of one-component magnetic brush development. E.Schnell (Sektion Math. & Phys., TH Otto von Guericke Magdeburg, Magdeburg, Germany).
J. Signalaufzeichnungsmater. (Germany), vol.11, no.1, p.55-68 (1983). In German.
A simple model for the description of dynamic current curves and development kinetics of a single component magnetic toner is presented. The toner material consist of a high resistance body with admixtures of ferromagnetic material. On the surface conducting islands are distributed. A critical comparison of the calculated and measured deposition curves is given. (12 refs.)

64974 The use of photographic space in the development of the disc photographic system. T.M.Rice, T.W.Faulkner (Eastman Kodak Co., Kodak Apparatus Div., Rochester, NY, USA).
J. Appl. Photogr. Eng. (USA), vol.9, no.2, p.52-76 (April 1983).
The concept of photographic space has been developed as a means to describe the light level and distance conditions under which amateur photographs are taken. Data have been collected to quantify the frequency of occurrence of picture-taking as a function of both light level and distance. To make use of this photographic space data, a pair of equations has been derived from basic photographic principles to describe the capability of any photographic system to cover photographic space, and to show how the prameters of a photographic system affect resultant coverage. The development of these equations is described, and their application to the definition of the disc photographic system is presented. Some of the supporting studies necessary to refine and optimize the disc system definition are also discussed. (8 refs.)

64975 The influence of film, paper, and printer spectral characteristics on photofinishing performance. W.C.Kress, P.J.Alessi (Eastman Kodak Co. Res. Labs., Rochester, NY, USA).
J. Appl. Photogr. Eng. (USA), vol.9, no.2, p.58-62 (April 1983).
Because of the diversity of products which the photofinisher may want to use, the interrelationships among the spectral properties of film, print material, and printer monitors are important. If films having spectral differences but obeying the silver criterion are to be printed using the same photofinishing printer setup, ideally the printer monitor response should be the same as the print material spectral sensitivities. An exact match between monitor and print material characteristics is both unnecessary and difficult to obtain; an approximation would be suitable. A modeling procedure is described which eliminates sensitometric differences between film samples and generates on-aim spectrometric characteristics. From these data, different printer monitor responses can easily be evaluated and compromises appraised. (3 refs.)

64976 A colorimetric determination of residual thiosulfate (hypo) in processed paper. D.Owerbach (Eastman Kodak Co., Photographic Technol. Div., Rochester, NY, USA).
J. Appl. Photogr. Eng. (USA), vol.9, no.2, p.66-70 (April 1983).
The existing ANSI standard for determining residual thiosulfate (hypo) in processed films and papers is not valid for certain kinds of photographic papers. The AnSI standard consists of two methods, the methylene blue method and the densitometric method. A colorimetric method for determining residual hypo in films, published in 1966, proved effective for paper samples that could not be measured by the methylene blue method. The colorimetric method consists of eluting thiosulfate from a paper sample, and then adding the eluent to an iodine-amylose solution. The loss of iodine-amylose color is a measure of the residual thiosulfate removed from the paper into the eluent. (6 refs.)

64977 A simple method of evaluating the polychromatic modulation transfer function for photographic systems. S.Vallmitjana (Dept. de Optica, Univ. de Barcelona, Barcelona, Spain), D.Navajas, J.J.Barandalla, J.R.de F. Moneo.
J. Opt. (France), vol.14, no.1, p.25-8 (Jan.-Feb. 1983).
A rapid method of the measurement of the polychromatic optical transfer function (POTF) of a total system-optics plus reversal colour film is described, based on the scanning and Fourier analysis of the photographic image of a slit. This scanning is carried out through a microdensitometer with a spectral response that has been adapted to be analogous to the human eye in photopic vision. The results of the curves calculated in different positions of the image plane by this method are compared with the curves calculated according to the integral extended to various monochromatic wavelengths. The values of the PMTF calculated by the proposed method are on average lower over the whole range of frequencies than those calculated by several wavelengths. In order to analyse the implications of these differences in image quality the authors have applied a numerical criterion of image quality to both methods, based on the area of the PMTF. The results indicate a strong statistical dependence between the two methods. (10 refs.)

64978 Adapting microscopes for instant photomicrography.
Lab. Equip. Dig. (GB), vol.21, no.4, p.92-3 (April 1983).
Many conventional photomiocrographic systems require technical expertise to calculate exposure and some waiting time to see the results. In contrst, photography is easy to use and gives immediate feedback. Polaroid instant films in 'peel-apart' form have been used for many years to make high-quality photomicrographs in a matter of minutes. The development of the SX-70 system opened new horizons for many types of photography, including photomicrography. If this system could be adapted to a microscope, a technician with little training in photography could turn out excellent instant micrographs without concern for exposure or development. (no refs.)

64979 Laboratory photographic equipment in focus.
Lab. Equip. Dig. (GB), vol.21, no.4, p.97-9 (April 1983).
Microprocessors are now coming to the aid of the laboratory photographer and photomicrographer. Fully automatic exposure control is just one of the recent advances featured in this review of photographic equipment. (no refs.)

64980 General Gaussian theory of mechanically compensated zoom lenses. III. Critical point and singular point of the zoom equation. K.Tanaka (Canon Res. Center, Canon Inc., Tokyo, Japan).
Opt. Commun. (Netherlands), vol.45, no.4, p.231-4 (15 April 1983). In German.
For pt.II see ibid., vol.43, no.5, p.315 (1982). An analysis is made on the critical point and singular point of the zoom equation, which governs the component movement of an *n*-component mechanically compensated zoom lens. In the neighbourhood of the special points, the zoom equation is approximately expressed by the quadratic form. A numerical example is also added. (12 refs.)

64981 Anisotropy induced in a silver chloride emulsion by two successive beams of white light perpendicularly polarized. M.Attia, S.Debrus, M.P.Henriot, M.May (Inst. d'Optique, Univ. Pierre et Marie Curie, Paris, France).
Opt. Commun. (Netherlands), vol.45, no.4, p.235-40 (15 April 1983).
Studies of the anisotropy induced in a silver chloride photographic emulsion by two successive beams of white light, linearly polarized at right angle. After the first exposure, the colloidal medium contains silver ellipsoids e generated by the photolysis of silver chloride and silver e_b resulting of the partial destruction of some of the previous ones by long wavelengths. This medium is then illuminated by the second beam linearly polarized at right angle of the first beam. Short wavelengths induce silver ellipsoids e′ identical to the ellipsoids e but rotated through $\pi/2$ with respect to them. As in the first exposure, some of them are partly broken up and transformed into ellipsoids e'_b identical to ellipsoids e_b but the direction of their major axis. Moreover, the long wavelengths of second exposure transform some of the particles e and e_b generated during the first exposure, into smaller ellipsoids e_{eb} and e_{bb}. Finally, the colloidal medium resulting from these two exposures, contains silver chloride and six types of silver particle. By calculating the indices of the medium, the authors show that the wavelengths characterizing the zero birefringence and zero dichroism of the emulsion are dependent of the energies recorded during each of the exposures. (17 refs.)

64982 Landsat multitemporal color composites. J.R.Eyton (Dept. of Geography, Pennsylvania State Univ., University Park, PA, USA).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.2, p.231-5 (Feb. 1983).
Landsat MSS and RBV images can be photographically color composited using scenes of the same spectral band obtained at three different dates. The resulting composite exhibits temporal information only, with areas of change displayed as various hues and areas of no change displayed as black and white tones. Images from three different years and images acquired at three different periods within the same year were used to construct several examples of a multitemporal color composite. This technique is particularly useful when applied to the single band, high resolution Landsat-3 RBV scenes. (3 refs.)

64983 Correcting the residual astigmatism of complicated photographic systems. V.V.Tarabukin.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.494-6 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.23-5 (Aug. 1982). [received: April 1983]
The possibilities of correcting the residual astigmatism in wide-angle and simultaneously large-aperture photographic systems are examined. A method is suggested for system correction by means of the parameters considered. (2 refs.)

64984 Effects of speckle recording on the diffraction halo in speckle photographs. L.Marti Lopez (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1367-9 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2224-8 (Nov. 1982). [received: May 1983]
The effects of the recording process on the diffraction halo in speckle photographs is considered. It is shown that the diameter of the diffraction halo, and hence the smallest measurable transverse displacement, depends on the characteristic curve, diffraction efficiency, and noise level in the photographic material. (5 refs.)

64985 Potentials of the continuous optical film printing method. N.D.Bernstein.
Tekh. Kino & Telev. (USSR), no.4, p.7-13 (April 1983). In Russian.
The author analyses the potentialities of the continuous optical printing method (COP) in film production and release printing processes. Some technical characteristics of the COP method are discussed. He considers a number of problems in cinematography development which may be solved using this method: film format conversions, search and introduction of new efficient methods of film production and release printing, unification of film printing equipment use of old film materials, etc. (12 refs.)

64986 The Kinor 35R II film camera. E.G.Bychko, L.Z.Kaplan, L.I.Ofitserov, S.A.Solomatin, S.I.Rudman.
Tekh. Kino & Telev. (USSR), no.4, p.14-15 (April 1983). In Russian.
Considers the design features of the Kinor 35R II film camera, which is an improved version of the Kinor 35R camera. (1 ref.)

64987 Methods for quality control of final film washing. G.V.Velichko, L.I.Veronovskii, I.I.Friedman, G.T.Khaitsova.
Tekh. Kino & Telev. (USSR), no.4, p.16-19 (April 1983). In Russian.
Considers three methods for determining the residual thiosulphate content in films. The most accurate and sensitive 'methylene blue' method permits finding thiosulphate in quantities as low as 0.00015 mg/cm^2. For rapid control a chemical-densitometric method is presented. (7 refs.)

64988 What should be film equipment for motion picture network?. V.B.Mun'kin.
Tekh. Kino & Telev. (USSR), no.4, p.19-24 (April 1983). In Russian.
The author considers the principles of determining a rational set of a film projection complexes according to the requirements of high quality film presentation, equipment reliability and operation conditions. (no refs.)

64989 On the problem of silver in photography. Yu.I.Zhurba, L.I.Mazina.
Tekh. Kino & Telev. (USSR), no.4, p.54-60 (April 1983). In Russian.
The problems of silver in photography are considered. Data on worldwide silver production and consumption, silver circulation in production and use of motion picture and photographic film materials are given. Methods of silver recovery from processing solutions and washing waters are described and their pros and cons are revealed. (26 refs.)

64990 A rational system for motion picture theatre operation control. V.I.Ushagina.
Tekh. Kino & Telev. (USSR), no.4, p.60-1 (April 1983). In Russian.
An automatic system for controlling a number of motion picture theatres developed and used in West Germany is described. (3 refs.)

Double-exposure speckle photography for the measurement of small displacements .... See Entry 64609

Processor controlled multichannel microdensitometry for gas electron diffraction patterns .... See Entry 64941

A compact synchroscan streak camera using a microchannel plate incorporated tube .... See Entry 66046

Application of Weigert effect to the pseudocoloration of a black and white signal .... See Entry 66224

Optimal regime for forming topological patterns when processing films with laser radiation .... See Entry 66319

Future lenses for 16-mm cinematograph projectors .... See Entry 66362

Experimental study on sluggish bubble behaviors in pressure waves .... See Entry 66612

Low-angle X-ray camera for the investigation of polymers exposed to loads and ultraviolet radiation .... See Entry 66784

Surface mobility of silver and gold on evaporated silver bromide layers .... See Entry 67401

07.75 MASS SPECTROMETERS AND MASS SPECTROMETRY TECHNIQUES

(for mass spectroscopic chemical analysis, see 82.80)

64991 A test apparatus for secondary ion mass spectrometry. N.Klaus (Inst. fur Experimentalphys., Univ. Wien, Wien, Austria), J.D.Brown.
Can. J. Phys. (Canada), vol.61, no.4, p.535-42 (April 1983).
A low cost test device for secondary ion mass spectrometry (SIMS) components is described. It consists of a turbomolecular pumped vessel containing an insulated sample stage on an *x-y* manipulator, extraction optics, quadrupole mass filter, and channel electron multiplier. The construction and characteristics of a cylindrical and a spherical saddlefield ion source are described. The output of the cylindrical source is 10^{-4} A cm^{-2} whereas that of the spherical source is in the order of 10^{-3} A cm^{-2} at voltages up to 9 kV and at a beam divergence of 4°. (7 refs.)

64992 Improvement of a pulse generator for the Atom-probe: doubling of pulse-voltage. E.Nomura, S.Horie, O.Nishikawa (Dept. of Materials Sci. & Engng., Tokyo Inst. of Technol., Yokohama, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L162-4 (March 1983).
In order to increase a pulse voltage, a stack of two mercury-wetted reed relays was employed as a switch for a voltage-pulse generator. The stacked relays doubled the attainable pulse voltage owing to an increase of breakdown voltage of the switch In the mass analysis of W with a high mass-resolution time-of-flight atom probe incorporating the new pulse generator, no deterioration of mass resolution is seen over a wide range of the pulse amplitude, verrifying the usefulness of the generator especially in the case where a high pulse voltage is required.

64993 Generation of t^{-2} voltage pulses for ion analysers. R.M.Clement, H.T.Miles (Dept. of Phys., Univ. Coll. of Swansea, Swansea, Wales).
J. Phys. E (GB), vol.16, no.5, p.377-81 (May 1983).
An electronic system is described for the generation of the t^{-2} voltage pulse used for ion separation in a particular form of time-of-flight ion energy analyser. The pulse is synthesised with an *RC*-network and the theory for the design of this special network is given in detail. A technique for making measurements on the pulse waveform is included and such measurements

show that the t^{-2} pulse produced experimentally had an accuracy of better than 3% over a voltage dynamic range of greater than 30 dB. Other applications of the work, which could involve voltage pulses different from the t^{-2} shape considered in detail, are suggested and the possibility of generating specially shaped pulses at a high voltage level is discussed. (6 refs.)

Calibration of an analyzing magnet using a time-of-flight technique .... See Entry 65795

Behavior of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. I. Experiment .... See Entry 66727

Behaviour of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. II. Theory .... See Entry 66728

Studies of surfaces of materials using low energy ion beams ... See Entry 68384

07.77 PARTICLE BEAM PRODUCTION AND HANDLING; TARGETS

(see also 29.25 in elementary-particle and nuclear physics, 41.80 Particle beams and particle optics)

64994 Stable atomic hydrogen possible application in intense polarized sources. T.Q.Niinikowski, S.Penttila, J.-M.Rieubland (CERN, Geneva, Switzerland).
AIP Conf. Proc. (USA), no.95, p.597-600 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors briefly review the status of spin-polarized atomic hydrogen and discuss a possible way of extending the present limit of density. Pulse extraction of stabilized atoms by millimetre wave is proposed as a means of producing polarized atomic beams of uniform velocity and low divergence. It is speculated that these atoms could be used either as jet targets of a conventional type, or as a stored atomic beam target by injecting them into a storage ring intersecting with an accelerator beam. When used in a polarized ion source, the high density of the atomic beam could possibly also improve the ionizer efficiency. (12 refs.)

64995 Atomic hydrogen source with direct helium cooling. T.O.Niinikoski, S.Penttila, J.-M.Rieubland (CERN, Geneva, Switzerland).
AIP Conf. Proc. (USA), no.95, p.601-3 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors have constructed a helium-cooled atomic source where the discharge tube is placed immediately above the helium bath. The advantages of our system are simplicity, very short length and therefore small losses of the atomic beam, and the possibility of cryopumping molecular hydrogen. Preliminary tests show the feasibility of these principles. Further work is aimed at geometrical and thermal improvements, and possibly the addition of a spin selection magnet near the cooling tube. (6 refs.)

64996 Proton polarimeters at high energy. K.Kuroda (LAPP, Annecy-le-Vieux, France).
AIP Conf. Proc. (USA), no.95, p.618-33 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
With the advent of multihundred GeV polarized proton beams the problem of calibrating beam polarization becomes primordial. Among various possible designs, those based on electromagnetic interactions are revealed quite promising. In particular, polarimeter using the Coulomb diffractive dissociation of proton on heavy nuclei would provide the best solution by reason of the high analyzing power and cross section. A more classical solution based on pp elastic scattering in the Coulomb-Nuclear interference region is also considered as a dependable method, not only for fixed target experiments, but also for the calibration of accelerating polarized protons. (30 refs.)

64997 Electromagnetic interference in high energy polarization. N.H.Buttimore (Trinity Coll., Dublin, Ireland).
AIP Conf. Proc. (USA), no.95, p.634-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The polarization of high energy protons may be determined from an asymmetry measurement in the hadron-electromagnetic interference region of proton-proton elastic scattering. The author examines a contribution to the expected 5% asymmetry from the single helicity-flip hadronic amplitude. An expression of polarization and spin rotation parameters allows the size and error of this contribution to be estimated over a range of momenta from 3.8 to 45 Gev/c. Indications are that the asymmetry approaches the expected asymptotic value with weak energy dependence $\simeq 1/\sqrt{\sigma}(\mathrm{tot})$. Nuclear targets display somewhat lower asymmetries than those of the proton, but they are comparable. (13 refs.)

64998 Carbon grid ion source. J.J.Cuomo, J.M.E.Harper, A.Kleinsasser (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.25, no.10, p.5070-1 (March 1983).
Describes how carbon ion extraction grids, used with controlled ion bombardment of the grids, sputter carbon onto the sample and can introduce a controllable amount of carbon into an oxide layer. (no refs.)

Radio frequency characteristics of traveling wave accelerating sections calculated using a model resonator .... See Entry 65713

An accelerating section with a constant acceleration rate .... See Entry 65714

Improvement of the energy spectrum in standing wave accelerators by delaying injection .... See Entry 65715

Elimination of resonances by Siberian snakes .... See Entry 65716

Generalized Froissart-Stora formula .... See Entry 65723

The acceleration of polarized protons .... See Entry 65740

Polarization precession in quadrupoles and sextupoles .... See Entry 65745

Polarised targets—what is happening .... See Entry 65746

Dynamic polarization in some high-hydrogen glasses .... See Entry 65747

A frozen spin polarized proton target for use at LAMPF .... See Entry 65748

Polarization measurements on irradiated ammonia .... See Entry 65749

Horizontal dilution refrigerator for use in intense proton beams .... See Entry 65750

A frozen spin target with three orthogonal polarization directions .... See Entry 65751

A spin flipper for thermal atomic beams .... See Entry 65765

Compensation of aberrations in achromatic quadrupole doublets .... See Entry 65785

Axially symmetric electrostatic and magnetic fields for ion beam focusing .... See Entry 65786

Autoacceleration of a modulated beam .... See Entry 65808

Electrostatic charged particle analyzer with three coaxial cylindrical electrodes. III. A three-stage analyzer with general ring-ring focusing .... See Entry 66201

Magnetic guiding, focusing and compression of an intense charge-neutral ion beam .... See Entry 66713

Spectroscopic Doppler-free methods for measuring the electric and magnetic fiels in magnetically insulated ion diodes .... See Entry 66758

Summary of the Fourth International Conference on ion implantation: equipment and techniques .... See Entry 67015

07.80 ELECTRON AND ION MICROSCOPES AND TECHNIQUES

(see also in condensed matter 61.16D Electron microscopy, 61.16F Field ion microscopy)

64999 Scanning tunnelling microscopy. G.Binnig, H.Rohrer (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.726-35 (1982).
Based on vacuum tunnelling, a novel type of microscope, the scanning tunneling microscope (STM) was developed. It has an unprecedented resolution in real space on an atomic scale. The authors review the important technical features, illustrate the power of the STM for surface topographies and discuss its potential in other areas of science and technology. (16 refs.)

Proceedings of the 21st Annual Conference of the Electron Microscopy Society of Southern Africa .... See Entry 64591

Measurements of high voltages by means of electron speed filtering .... See Entry 64917

Improvement of a pulse generator for the Atom-probe: doubling of pulse-voltage .... See Entry 64992

Generation of t^{-2} voltage pulses for ion analysers .... See Entry 64993

A contribution to the study of electron diffraction fringes at the edge of a screen using energy filtering and field emission .... See Entry 66196

Channeling contrast microscopy: Application to semiconductor structures .... See Entry 67069

Total current spectra in transmitted and reflected electrons .... See Entry 68381

Applications of analytical electron microscope in metal structure analysis. Energy dispersive spectroscopy (EDS) .... See Entry 68735

Field induced and surface catalyzed formation of novel ions: a pulsed-laser time-of-flight atom-probe study .... See Entry 68796

Proton induced characteristic X-ray radiography .... See Entry 68827

The revelation of dynamic contamination ion species and their mass characteristics in ion microprobe mass analysis .... See Entry 68838

Performance of neutron radiography systems using particle accelerators .... See Entry 69001

The determination of platinum in human tissues with PIXE .... See Entry 69074

07.85 X-RAY, GAMMA-RAY INSTRUMENTS AND TECHNIQUES

65000 Static-wavelength independent radiation attenuator. P.L.Csonka (Inst. of Theoretical Sci., Univ. of Oregon, Eugene, OR, USA).
Appl. Opt. (USA), vol.22, no.8, p.1149-59 (15 April 1983).
The static radiation attenuator consists of one or several layers of absorbing material into which randomly distributed holes are drilled. The attenuator needs no moving parts and reduces not only the time averaged but also the instantaneous brightness, and reduction by an arbitrarily large factor can be easily achieved. The transmitted intensity fluctuates randomly as a function of spatial position, but the expected fluctuation can be evaluated and can be made arbitrarily small. Various properties of the device are explored. (7 refs.)

65001 Uniform and graded multilayers as X-ray optical elements. Ping Lee (Ball Aerospace Systems Div., Boulder, CO, USA).
Appl. Opt. (USA), vol.22, no.8, p.1241-6 (15 April 1983).
A detailed comparison of the performance of uniform and graded multilayers as soft X-ray monochromators and normal incidence collectors has been made. In particular, the responses of flat depth-, and laterally graded multilayers to Al K_α radiation, $\lambda = 8.34$ Å, have been computed and compared with the corresponding uniform multilayer. Furthermore, the efficiency of graded and uniform multilayers as normal incidence X-ray collectors has been calculated in terms of effective areas for parabolic reflectors tuned to the OK_α line, $\lambda = 23.7$ Å. Finally, the effective areas of four strong solar emission lines in the 30-60 Å region have been computed for uniform multilayers. Normal incidence multilayer mirrors are well suited for spectroheliograph type of applications. (12 refs.)

65002 A simple method for measuring the noise of amplifying foils. M.Wolf, A.M.Gurvic (Forschungsinst. fur Lungenkrankheiten & Tuberkulose, Berlin, Germany), M.A.Il'ina.
J. Signalaufzeichnungsmater. (Germany), vol.11, no.1, p.31-9 (1983). In German.
A simplified method for the measurement of screen noise (quantum+structured noise) in radiographic film-screen-systems is described, that in principle can be applied to all systems, where blurred noise is photographically recorded. The method is based on one developed by Volke (1978, 1979) where the variance of density values is determined, that are measured with diaphragms of different size (microphotometer) from a uniformly exposed field. The method was extended to quadratic diaphragms and a measurement scheme was developed that reduces the number of measurements without intolerable reduction of accuracy. The number of calculations necessary is reduced by a number of diagrams. (7 refs.)

65003 Exposure-time determination in radiography. I.V.Borovin (Uralkhimmash Production Organization, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.657-60 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.85-8 (Aug. 1982). [received: April 1983]
A method is considered for determining the absorption coefficient (total interaction cross section) for a broad γ-ray beam. It is desirable to use an X-ray film as the detector in such radiographic measurements. (6 refs.)

A radioisotope method of thickness measurement for rhodium plating on rings .... See Entry 64888

Coming in close with Minac [nuclear power plant radiography] .... See Entry 65693

Research using synchrotron radiation at the National Synchrotron Light Source .... See Entry 65725

An absolutely calibrated source of 6.13 MeV gamma-rays ...... See Entry 65793

Bismuth germanate as a high-energy gamma-ray detector ...... See Entry 65827

A precision two-crystal X-ray spectrometer for producing oscillation curves .... See Entry 66783

Low-angle X-ray camera for the investigation of polymers exposed to loads and ultraviolet radiation .... See Entry 66784

Proton induced characteristic X-ray radiography .... See Entry 68827

X-ray fluorescence analysis with a linear polarized beam after Bragg reflection from a flat or a curved single crystal .... See Entry 68840

The computer increases the sharpness of X-ray diagnosis .... See Entry 68997

High efficiency spectrographs for the EUV and soft X-rays .... See Entry 69502

Space and time resolved soft X-ray spectra using X-ray transmission gratings .... See Entry 69505

07.90 OTHER TOPICS IN SPECIALISED INSTRUMENTATION

Direct verification of the quantum spin-state superposition law .... See Entry 64719

10.00 THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

(for cosmic rays, see 94.40; for high energy-experimental techniques and instrumentation, see 29.)

Cosmology and elementary particles .... See Entry 69761

11.00 GENERAL THEORY OF FIELDS AND PARTICLES

(see also 03.65 Quantum mechanics, 03.70 Theory of quantized fields, 03.80 General theory of scattering)

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received) .... See Entry 64598

11.10 FIELD THEORY

65004 The 't Hooft-Polyakov monopole near the Prasad-Sommerfield limit. C.L.Gardner (Center for Theoretical Phys., MIT, Cambridge, MA, USA).
Ann. Phys. (USA), vol.146, no.1, p.129-48 (March 1983).
A perturbative classical monopole solution for the $SO(3)$ gauge theory is constructed in the limit of small but nonvanishing Higgs potential. This corresponds to the limit $\mu^2/2M_W{}^2=\lambda\ll 1$, where μ equals the mass of the scalar particle and M_W equals the mass of the intermediate vector particles. The monopole solution and mass are found to involve nonanalytic functions of λ: $\sqrt{\lambda}$ and $\lambda \ln \lambda$. (11 refs.)

65005 Rites of spin. D.Sivers (High Energy Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
AIP Conf. Proc. (USA), no.95, p.13-27 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Some simple examples which deal with spin degrees of freedom in gauge theories are examined for clues concerning the role of spin in formulating new theoretical ideas. (26 refs.)

65006 Renormalization scheme dependency and decoupling in the mass independent renormalization scheme. G.McKeon (Dept. of Appl. Math., Univ. of Western Ontario, London, Ontario, Canada).
Can. J. Phys. (Canada), vol.61, no.4, p.564-70 (April 1983).
The problem of renormalization scheme dependency that occurs when one employs mass independent renormalization is examined. In order to render this renormalization scheme viable in practical calculations, a way of decoupling heavy fields by demanding that the Appelquist-Carazzone theorem be satisfied at the outset is devised. (20 refs.)

65007 Gauge potentials and bundles over the 4-torus. C.Nash (Dept. of Math. Phys., St. Patrick's Coll., Maynooth, Ireland).
Commun. Math. Phys. (Germany), vol.88, no.3, p.319-25 (March 1983).
The construction of principle bundles over a four-dimensional torus is considered. The class of groups considered is $SU(n)/Z_n$, and for this class the Pontrjagin class has even integer values. (6 refs.)

65008 Local aspects of superselection rules. II. S.Doplicher, R.Longo (Istituto Matematico G. Castelnuovo, Univ. di Roma, Roma, Italy).
Commun. Math. Phys. (Germany), vol.88, no.3, p.399-409 (March 1983).
For pt.I see ibid., vol.85, p.73 (1982). In a theory where the local observables are determined by local field algebras as the fixed points under a (a priori noncommutative) group of gauge transformations of the first kind, the authors show that, if the field algebras possess intermediate type I factors, they can construct observables having the meaning of local charge measurements, and local current algebras in the field algebras. (18 refs.)

65009 $(\mathrm{Higgs})_{2,3}$ quantum fields in a finite volume. III. Renormalization. T.Balaban (Dept. of Phys., Harvard Univ., Cambridge, MA, USA).
Commun. Math. Phys. (Germany), vol.88, no.3, p.411-45 (March 1983).
For pt.II see ibid., vol.86, p.555-94 (1982). This contains a proof of the bounds on the effective actions needed in the two previous papers. The proof is based on perturbative analysis of renormalization. (3 refs.)

65010 On GL(4,R)-covariant extensions of the Dirac equation. J.Mickelsson (Mittag-Leffler Inst., Djursholm, Sweden).
Commun. Math. Phys. (Germany), vol.88, no.4, p.551-67 (1983).
Infinite component generalizations of both massless and massive Dirac equations are constructed which are covariant with respect to the double covering of the general linear group in four dimensions. These generalized Dirac equations can be made covariant with respect to the full diffeomorphism group of the spacetime manifold by replacing ordinary derivatives by covariant derivatives in the usual way. (8 refs.)

65011 On the massive sine-Gordon equation in the higher regions of collapse. F.Nicolo (Istituto di Matematica, Univ. di Roma, Roma, Italy).
Commun. Math. Phys. (Germany), vol.88, no.4, p.581-600 (1983).
Proves that the renormalization program discussed by Benfatto et al. (1982) can also be developed beyond the $\bar{\alpha}^2=2\pi(\sqrt{17}-1)$ threshold. This result also allows a simplification in the technical part of the proof of ultraviolet stability in the $\phi_3{}^4$-theory. The author discusses, heuristically, but in some detail the interpretation of the sine-Gordon theory as a two-dimensional Yukawa gas for $\beta e^2=\alpha^2>4\pi$. (4 refs.)

65012 Efficient implementation of the Monte Carlo method for lattice gauge theory calculations on the floating point systems FPS-164. K.J.M.Moriarty (Dept. of Math., Royal Holloway Coll., Englefield Green, England), J.E.Blackshaw.
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.155-61 (April 1983).
The computer program calculates the average action per plaquette for $SU(6)/Z_6$ lattice gauge theory. By considering quantum field theory on a space-time lattice, the ultraviolet divergences of the theory are regulated through the finite lattice spacing. The continuum theory results can be obtained by a renormalization group procedure. (13 refs.)

65013 On the single point field theories. G.Parisi (Tor Vergata Univ. Roma, Roma, Italy), Zhang Yi-Cheng.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.408-20 (2 May 1983).
A systematic approach to reduce the dynamical degrees of freedom is presented. Certain field theory models with non-trivial large-N limit defined in the infinite volume are shown to be reduced to theories defined at a single point in space-time when $N\to\infty$. (17 refs.)

65014 Decay of the false vacuum at finite temperature. A.D.Linde (Lebedev Phys. Inst., Moscow, USSR).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.421-45 (2 May 1983).
Studies kinetics of the first-order phase transitions in gauge theories with spontaneous symmetry breaking. A general theory of the decay of the metastable phase (false vacuum) at a finite temperature is developed. A number of concrete examples are considered, which will make it possible to study kinetics of phase transitions in a wide class of theories without complicated computer calculations. (41 refs.)

65015 A lagrangian formulation of the Wess approach to supersymmetric Yang-Mills theories. P.A.Marchetti (Scuola Internazionale Superiore di Studi Avanzati, Trieste, Italy), P.Pasti, M.Tonin.
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.446-58 (2 May 1983).
The authors obtain a superspace lagrangian density which reproduces the Wess formulation of sypersymmetric gauge theories. The present approach, which is a first-order formalism, gives rise to a lagrangian density polynomial in the Yang-Mills and auxiliary superfields and appears to be stable under quantization and renormalization. (16 refs.)

65016 The quantum mechanical supersymmetric O(3) and O(2,1) σ-models. A.C.Davis, A.J.MacFarlane, J.W.van Holten (CERN, Geneva, Switzerland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.493-507 (2 May 1983).
The authors study and solve the reductions to $(0+1)$ space-time dimensions of the O(2,1) and O(3) supersymmetric δ-models. By explicitly solving their Schrodinger equation they have calculated the spectra for the models. Results show that supersymmetry is not broken in these field theories. Another interesting result is that in the non-compact model the inclusion of fermions gives rise to the appearance of an infinite multiplet of discrete zero-energy states, which are absent in the purely bosonic model. This implies that the O(2,1) symmetry is spontaneously broken. (14 refs.)

65017 Renormalization-group analysis of supersymmetric mass hierarchies. H.Yamagishi (Dept. of Phys., Princeton Univ., Princeton, NJ, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.508-46 (2 May 1983).
A renormalization-group analysis is performed for supersymmetric models of the O'Raifeartaigh (1965) type coupled to a Yang-Mills supermultiplet. For an appropriate range of coupling constants, the author finds that large mass ratios can be naturally generated by one-loop corrections to the effective potential. The results confirm Witten's (1981) recent observation that these models provide a potential solution to the gauge hierarchy problem. The general renormalization-group analysis of symmetry breaking developed in this paper is applicable in contexts other than supersymmetry. They also give a simple argument that the canonical form of the supersymmetric Ward identities can be maintained in the presence of quantum effects. (77 refs.)

65018 Principal orbits and the Yang-Mills-Higgs model. P.Houston (CERN, Geneva, Switzerland).
J. Phys. A (GB), vol.16, no.6, p.1117-24 (21 April 1983).
The author gives a strong necessary condition for the principal stabiliser of the action of a compact Lie group to have a non-zero centre. An application to the monopole problem in Yang-Mills-Higgs models is discussed. (12 refs.)

65019 The ground-state solutions of the conformally covariant spin-2 wave equation. J.Fang (Dept. of Phys., California State Polytech. Univ., Pomona, CA, USA), W.Heidenreich, B.W.Xu.
J. Phys. A (GB), vol.16, no.7, p.L225-8 (11 May 1983).
The most general ground-state solutions of the second-order conformally covariant spin-2 wave equations are obtained. The spin-2 field is represented by the symmetric rank-two tensor of the conformal group. The authors find that none of the ground-state solutions belong to a unitary irreducible representation of the conformal group. (3 refs.)

65020 The monopole's spinor fields. G.A.Ringwood.
J. Phys. A (GB), vol.16, no.7, p.L235-7 (11 May 1983).
It is shown that the Wu-Yang monopole is described, completely geometrically, by the Kustaanheimo-Stiefel (1965) bundle. Sections of the tangent space to the bundle are spinor fields, showing that this monopole is an intrinsically spin one half particle. (6 refs.)

65021 Gauge differential form theories on the lattice. C.Omero (Istituto di Fisica Teorica, Univ. di Trieste, Trieste, Italy), P.A.Marchetti, A.Maritan.
J. Phys. A (GB), vol.16, no.7, p.1465-74 (11 May 1983).
Discusses gauge differential form theories on the lattice which have Kalb-Ramond (1974) theories of interacting r and $r-1$ forms as naive continuum limit; the Higgs character of the $r-1$ form is clearly displayed. The authors derive some inequalities useful for drawing tentative phase diagrams and analyse the existence of θ-vacua. (28 refs.)

65022 Equivalent Lagrangians in field theory. J.R.Farias, N.L.Teixeira (Dept. de Fisica, Univ. Federal de Paraiba, Paraiba, Brazil).
J. Phys. A (GB), vol.16, no.7, p.1517-21 (11 May 1983).
A theorem by Hojman and Harleston (1981) for multidimensional equivalent Lagrangians (L and $\bar{L}$) in the realm of Newtonian mechanics is generalised to field theory. Equivalent Lagrangians for some set of field equations are found. (5 refs.)

65023 Orbit space and minima of Landau-Higgs potentials. M.V.Jaric (Inst. des Hautes Etudes Sci., Bures-sur-Yvette, France).
J. Math. Phys. (USA), vol.24, no.4, p.917-21 (April 1983).
The author establishes a connection between recent propositions for minimization of Higgs potentials in an orbit space and related treatments in the Landau theory of phase transitions. Starting from isotropy groups he gives a simple and systematic procedure for determining a stratification in an orbit space. As an illustration he treats the point groups O_h and T_d which occur in the Higgs mechanism for SO_7 and SU_4 adjoint representations. (17 refs.)

65024 On the two-point functions of some integrable relativistic quantum field theories. S.N.M.Ruijsenaars (Dept. of Math., Texas A&M Univ., College Station, TX, USA).
J. Math. Phys. (USA), vol.24, no.4, p.922-31 (April 1983).
Two-point functions associated with the Federbush, massless Thirring, and continuum Ising models and their boson analogs are studied. In the Thirring case it is shown that the fields do not define operator-valued distributions, while temperedness of the two-point Wightman function is proved in the Ising case and in the Federbush case for a certain range of coupling constants. By relating the short-distance singularity of the Schwinger functions to the high-energy behavior of the spectral measures it is shown the fields cannot be made to satisfy the CCR/CAR by a rescaling. In the fermionic Federbush case this breakdown of the CAR occurs in spite of the fact that the fields correspond to a local Lagrangian. (9 refs.)

65025 Particle states and scattering theory in abelian gauge model with spontaneously broken symmetry. G.Bishop (Dept. of Phys., Univ. of Rhode Island, Kingston, RI, USA), K.Haller.
J. Math. Phys. (USA), vol.24, no.4, p.932-48 (April 1983).
This is an exposition of the electrodynamics of the ϕ^4 theory with a spontaneously broken U(1) symmetry. The Lagrangian in a manifestly covariant gauge is used to construct the Hamiltonian and canonical commutation rules. Part of the Hamiltonian is a 'free-field' Hamiltonian which describes noninteracting massive spin-1 Proca bosons, Higgs bosons, and ghosts. The remainder of the Hamiltonian is a perturbation for which an interaction picture is developed and Feynman rules are systematically derived by the Dyson-Wick procedure. The choice of the 'free-field' Hamiltonian is based on earlier work, in which the particle spectrum was identified and verified explicitly by implementing Lorentz boosts on particle states. It is shown that application of the subsidiary condition and inclusion of interactions in evaluating positive frequency parts of gauge fixing fields is not only essential for consistency, but in this case also of practical importance in the proper identification of the Proca bosons. (18 refs.)

65026 Yang-Mills theory in null-path space. S.L.Kent (Dept. of Math. & Statistics, Univ. of Pittsburgh, Pittsburgh, PA, USA), E.T.Newman.
J. Math. Phys. (USA), vol.24, no.4, p.949-59 (April 1983).
The authors define a GL(n,C) matrix-valued function G on a six-dimensional space of null paths in Minkowski space. Such paths are defined to begin at an arbitrary spacetime point x^a and end at future null infinity. The space of these paths can thus be parametrized by giving the point x^a and null direction. They show how knowledge of G can be used to obtain the GL(n,C) Yang-Mills connection at x^a. They also derive a single equation for G, involving characteristic data given on null infinity, which is equivalent to the currentless or vacuum Yang-Mills field equations. The self-dual (anti-self-dual) nonabelian fields and the general abelian cases are described as special examples. (14 refs.)

65027 On the generalization of the 't Hooft field strength in the Yang-Mills-Higgs model. P.Houston (Inst. Hautes Etudes Sci., Bures-sur-Yvette, France).
J. Math. Phys. (USA), vol.24, no.4, p.960-8 (April 1983).
The generalization to the gauge groups SU(n) and SO(n) of the 't Hooft electromagnetic field is considered for finite energy configurations of the Yang-Mills-Higgs model, and it is shown how this results in the association of sets of integer changes with any closed surface. Differential inequalities satisfied by the Higgs invariants are presented, and their implications are discussed. (13 refs.)

65028 A particle representation for Korteweg-de Vries solitons. G.Bowtell, A.E.G.Stuart (Dept. of Math., City Univ., London, England).
J. Math. Phys. (USA), vol.24, no.4, p.969-81 (April 1983).
In an earlier paper (1977) the authors established an equivalence between the dynamics of interacting sine-Gordon solitons and the motions of poles of the corresponding Hamiltonian density. In particular, they found analytic expressions for the forces acting between the solitons and used these to represent the N-soliton solution as an N-body interaction between classical particles. In this paper, they apply the methods of their previous analysis to obtain a dynamically equivalent particle representation for interacting Korteweg-de Vries solitons. The representation is faithful and a detailed analysis is present for the one- and two-soliton solutions. In these cases the particle motions accurately reflect the behavior of the solitons, giving, respectively, a uniform motion and a repulsive interaction. Furthermore, in the case of the two-soliton solutions, the phase shifts calculated from the particle trajectories are the same as those obtained from an asymptotic analysis of the waveforms. Because of the nature of the Korteweg-de Vries equation, there are important differences between the present analysis and that employed for the sine-Gordon equation and these are discused in some detail. A comparison with related work on other solutions of the Korteweg-de Vries is also presented. (20 refs.)

65029 Group-theoretical analysis of the sine-Gordon equation as a relativistic dynamical system. L.Martinez Alonso (Departamento de Metodos Matematicos de la Fisica, Univ. Complutense, Madrid, Spain).
J. Math. Phys. (USA), vol.24, no.4, p.982-9 (April 1983).
The inverse scattering transform method is used in order to achieve a group-theoretical characterization of the sine-Gordon equation considered as a relativistic dynamical system. The action of the Poincare group is formulated in terms of scattering data variables and the three basic components of the sine-Gordon field, namely, solitons, breathers and radiation are identified with simple canonical realizations of the Poincare group. In particular, the nonlinear flow associated with the one-parameter group of pure Lorentz transformations is integrated by means of the inverse scattering transform method. (15 refs.)

65030 Lorentz transformation properties of nonconserved charges. C.M.Bender, D.A.Williams (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
J. Math. Phys. (USA), vol.24, no.4, p.990-5 (April 1983).
If a current $j^{\mu}(x)$ is conserved, then the charge Q defined as the three-space integral of $j^0(x)$ is a Lorentz scalar. In this paper the authors investigate the Lorentz transformation properties of Q assuming that $j^{\mu}(x)$ is not conserved; that is, $\partial_{\mu}j^{\mu}(x)\neq 0$. They find that Q, which now depends on time, transforms as the infinite direct sum of the spin-0 component of an infinite-dimensional indecomposable representation of the Lorentz group, $[(0,1)\rightarrow(1,0)]:[(0,1)\rightarrow(1,0)]\ \oplus\Sigma_{j=0\oplus}^{\infty}\ (0,2j+1)$, where they are using the Gel'fand, Milnos, and Shapiro (1963) notation. More simply, if $T^{\mu1\mu2\ldots\mu n}(x)$ is an n-index traceless, symmetric tensor density and $S(x)$ is a density transforming as the spin-0 component of the infinite-dimensional representation, they find that Q transforms as the infinite sum $S(x)+T(x)+T^{00}(x)+T^{0000}(x)+\ T^{000000}(x)+\ldots.$ (8 refs.)

65031 Can poles change color?. J.Tafel, A.Trautman (Inst. Fizyki Teoretycznej, Uniwersytetu Warszawskiego, Warsaw, Poland).
J. Math. Phys. (USA), vol.24, no.5, p.1087-92 (May 1983).
The definition of the total nonAbelian charge ('color') in a classical Yang-Mills theory is shown to require a careful analysis of the boundary conditions at infinity imposed on the potentials and on gauge transformations. The color current of a nonAbelian plane wave is found to be different from zero in the transverse gauge, though it vanishes in the null gauge. The color charge of a single pole, described by the Lienard-Wiechert potentials, is constant by virtue of the Yang-Mills equations. An approximate computation indicates that the total color charge of a system of particles may change in time, as a result of radiation. To make this result meaningful, it is necessary to find a method of fixing the allowed gauge transformations to those having a direction-independent limit at infinity. (16 refs.)

65032 Spinors in two dimensions. Ping Yip (Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1206-12 (May 1983).
The issue of the meanings of 'spinors' in two-dimensional Minkowski spacetime is investigated. Spinors in two dimensions are defined and shown to behave like the familiar spinors in four dimensions. Both of them can be interpreted as square roots of vectors, and both of them describe fermions in a quantum field theory. The author also shows that an analogous version of the spin-statistics theorem holds in two-dimensional Minkowski spacetime. (6 refs.)

65033 Canonical structure of the CP_2^{n-1} model in some noncovariant gauges. E.Gozzi (Phys. Dept., City Univ. of New York, New York, NY, USA), A.Guha.
J. Math. Phys. (USA), vol.24, no.5, p.1213-18 (May 1983).
The canonical structure of the CP_2^{n-1} model is derived in four different noncovariant gauges using the Dirac method for constrained Lagrangian systems. A suitable quantization scheme is proposed for all n. (17 refs.)

65034 Conformal invariance conditions for spinor fields with gauge freedom. M.Legare (Centre de Recherche de Math. Appl., Univ. de Montreal, Montreal, Quebec, Canada).
J. Math. Phys. (USA), vol.24, no.5, p.1219-23 (May 1983).
The global invariance conditions are given for the (j,j') spinor fields with gauge freedom invariant under subgroups of C(3,1). The author formulates two propositions concerning the nonexistence of nontrivial fields with and without compact gauge freedom and applies them to the maximal noncompact subgroups of C(3,1). The author also determines explicitly the most general O(4) and O(2)×O(4) invariant (j,j') spinor fields with compact gauge freedom. (12 refs.)

65035 Self-dual Yang-Mills fields. J.R.Porter (Dept. of Math. & Statistics, Univ. of Pittsburgh, Pittsburgh, PA, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1224-32 (May 1983).
The realization of self-dual Yang-Mills fields as nonlinear superpositions of plane waves is treated in analogy with electromagnetism. Despite the nonlinear nature of the fields, there is a complete correspondence between the two theories. The asymptotic behavior of asymptotically flat fields is examined and the plane wave components are shown to decouple on $\mathcal{J}^-$ and on $\mathcal{J}^+$ for such fields and to exhibit the character of linear fields when viewed as propagating from $\mathcal{J}^{-1}$ to $\mathcal{J}^+$. (8 refs.)

65036 Self-dual Yang-Mills fields on Minkowski space-time. J.R.Porter (Dept. of Math. & Statistics, Univ. of Pittsburgh, Pittsburgh, PA, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1233-9 (May 1983).
Self-dual Yang-Mills fields are realized as superposition, but in a nonlinear context, of plane wave fields. The mathematical analysis of such superposition (and the inverse problem of decomposition) is given in terms of connections on the prime spin bundle over Minkowski space-time. This view leads naturally to the twistor construction for such fields given by Ward (1977) as well as a CR version of this construction. (3 refs.)

65037 On a class of synchronized observers attached to the Lorentzian structures. B.Coll, C.Moreno (Coll. de France, Paris, France).
J. Math. Phys. (USA), vol.24, no.5, p.1245-55 (May 1983).
The first-order evolution form for the Klein-Gordon equation is characterized by an operator $T(t)$ which, for inertial observers in the Minkowski space-time, is skew-self-adjoint with respect to the energy product. This fact is essential for a rigorous treatment of the equation. The authors prove that, in arbitrary Lorentzian structures, there always exists a class of 'synchronized observers' (equivalence class of physically admissible local charts), here called adjoint systems, for which this property of $T(t)$ remains true. They are completely determined by the Lorentzian structure, and, in this sense, they appear as a suitable generalization of the Killing vector fields. They obtain the definition equations for such observers and state some of their properties. A particular class of them, here called simple adjoint systems, has already been introduced (1980) for the study of the Klein-Gordon equation in arbitrary space-times, according with Lichnerowicz's quantization program (1964). (21 refs.)

65038 Minimal electromagnetic coupling schemes. II. Relativistic and nonrelativistic Maxwell groups. J.Beckers, V.Hussin (Inst. de Phys. au Sart Tilman, Univ. de Liege, Liege, Belgium).
J. Math. Phys. (USA), vol.24, no.5, p.1295-8 (May 1983).
For pt.I see ibid., vol.24, p.1286-94 (1983). Minimal electromagnetic coupling schemes entering into Klein-Gordon or Schrodinger equations are studied in connection with symmetries outside the symmetry groups of the corresponding free equations. The Schrader construction of the so-called (relativistic) Maxwell group is reviewed through group extensions of kinematical groups asso-

ciated with (constant and uniform) electromagnetic fields. The construction of the Galilean (nonrelativistic) Maxwell group is given. (13 refs.)

65039 Magnetic-charge conjugation and the topological nature of magnetic monopole. K.L.Chang (Dept. of Phys., Nat. Taiwan Univ., Taipei, Taiwan).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.574-8 (23 April 1983).
Formulates the electromagnetic field tensor for the Yang-Mills-Higgs system, with arbitrary isospin of Higgs fields. Instead of introducing the unit isovector explicitly, the electromagnetic field tensor is constructed to be of definite transformation property under an additional discrete symmetry operation, called magnetic-charge conjugation. The author also uses this criterion to demonstrate that the magnetic charge of the monopole can also be quantized in the model with a Higgs doublet. (8 refs.)

65040 Co-ordinates for fermions. K.Mita (Div. of Natural Sci. & Math., St. Mary's Coll. of Maryland, St. Mary's City, MD, USA).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.176-84 (21 March 1983).
The author presents an examination of the Dirac matrices as spin co-ordinate. The field depending on the Minkowski space-time x and the Dirac matrices γ is introduced. The orbital and spin parts of the angular momentum appear on an equal footing when x and γ are Lorentz transformed simultaneously. (14 refs.)

65041 Energetic stability criterion for a nonlinear spinorial model. A.Alvarez (Dept. de Fisica Teorica, Univ. Complutense, Madrid, Spain), M.Soler.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1230-3 (25 April 1983).
The time evolution of expanded and contracted solitary waves of the Dirac field with scalar self-interaction is exhibited. It is shown that the positivity of the second variation of the energy functional is not a necessary condition for the stability of these waves as has been recently suggested. (12 refs.)

65042 Some remarks on the symmetry algebras of soliton equations. T.Koikawa (Brookhaven Nat. Lab., Assoc. Univ. Inc., Upton, Long Island, NY, USA), R.Sasaki.
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.85-8 (21 April 1983).
For a wide class of soliton equations in $1+1$ dimensions an infinite set of symmetry transformations obeying the Kac-Moody Lie algebra is obtained. These symmetry transformations, however, can be applied only within a limited domain of the x (space) variable. This restriction applies, in particular, to the Heisenberg spin chain and the nonlinear Schrodinger equation for which a Kac-Moody structure was recently derived by Eichenherr, (1982). (9 refs.)

65043 Hadron spectrum, spontaneous breaking of Z(3) and fake loops in lattice SU(3). R.Gupta, A.Patel (California Inst. of Technol., Pasadena, CA, USA).
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.94-8 (21 April 1983).
The authors calculate the hadron mass-spectrum using the Wilson action and in the quenched approximation on a $6^3\times10$ lattice at $\beta=6.0$. They show the existence of long-lived metastable states of the gauge field, characterized by the eigenvalue of Z(3). The hadron masses are very different in these states and do not agree with the experimental value. (12 refs.)

65044 Background-field method and the renormalisation of non-Abelian gauge theories in curved space-time. D.J.Toms (Blackett Lab., Imperial Coll., London, England).
Phys. Rev. D (USA), vol.27, no.8, p.1803-13 (15 April 1983).
The gauge-invariant background-field approach is used to discuss a non-Abelian gauge theory containing fermions in curved space-time. Renormalisation of the theory at the one-loop level is presented using dimensional regularisation, heat-kernel techniques and a curved-space-time momentum-space method. (39 refs.)

65045 Inhomogeneous axial gauges. A.Burnel (Inst. de Phys. au Sart Tilman, Univ. de Liege, Liege, Belgium).
Phys. Rev. D (USA), vol.27, no.8, p.1830-9 (15 April 1983).
Inhomogeneous axial gauges are investigated chiefly in the framework of free-field (Abelian) theory. According to the spacelike or timelike character of the fixed four-vector and the nature of the coupling between the Lagrangian multiplier and the gauge fields, these gauges involve 2, 3, 4, or even 5 degrees of freedom, of which only two are physical. Gauges with 4 or 5 degrees of freedom involve an indefinite-metric formalism which is built with some details in complete parallelism with relativistic gauges. It is shown that the temporal gauges are not related to the Fermi gauge by a transformation $A'_\mu=A_\mu+\partial_\mu X$. The absence of Faddeev-Popov ghosts in the non-Abelian case is also discussed as well as the nature of the $(n.k)^{-\alpha}$ singularities in the propagator. (17 refs.)

65046 Nonperturbative approach to the infrared behaviour in physical charged sectors of gauge theories. E.d'Emilio (Istituto di Fisica, Univ. di Pisa, Pisa, Italy), M.Mintchev.
Phys. Rev. D (USA), vol.27, no.8, p.1840-51 (15 April 1983).
Physical charged fields in Abelian gauge theories with unbroken global gauge symmetry are constructed. The Bloch-Nordsieck approximation is then used for the investigation of their mass-shell behaviour in both cases of unconfined and confined global charge. In the former case (the authors consider spinor QED) physical charged fields are found to have vanishing infrared anomalous dimension and to admit the conventional Lehmann-Symanzik-Zimmermann (LSZ) limit. In the latter case (they consider a toy model obtained from QED by replacing the photon with a dipole gluon) it turns out that physical charged fields have zero LSZ limit and the relative Green's functions exhibit an essential singularity in the coupling constant g at $g=0$. Moreover, the perturbative expansion of these Green's functions, although asymptotic, is not Borel summable. (34 refs.)

65047 Four-dimensional CP^2 model on a lattice. K.M.Bitar, R.Raja (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1894-902 (15 April 1983).
The authors investigate the phenomenon of dynamical generation of gauge interactions from CP^{N-1} models in four dimensions. They do this for the CP^2 model on a lattice. The phase diagram of a model that interpolates between CP^2 and U(1) gauge theory on a lattice is first mapped out. The potential between static charges in various regions of this diagram is also measured. Contrary to hopes based on the large-N behavior of similar models in two dimensions and on the phase diagram, they find that the potentials generated by CP^2 do not bear any resemblance to those of U(1). They are rather similar to the Higgs phase of an Abelian gauge theory in both phases displayed by CP^2. (15 refs.)

65048 Time-dependent solutions of Yang-Mills equations related to the Wu-Yang magnetic monopole. H.Arodz (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Phys. Rev. D (USA), vol.27, no.8, p.1903-9 (15 April 1983).
A class of time-dependent, spherically symmetric solutions of Yang-Mills equations is found. The solutions describe a transformation of the initial color-electric and magnetic fields into the Wu-Yang magnetic monopole. (8 refs.)

65049 Class of very simple gauge theories which remain renormalizable even in the limit of infinite gauge coupling constant. S.Kaptanoglu (Inst. for Theoretical Phys., State Univ. of New York, Stony Brook, NY, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1910-21 (15 April 1983).
A class of local gauge theories based on compact semisimple Lie groups is studied in the limit of infinite gauge coupling constant ($g=\infty$). In general, in this limit, the gauge fields become auxiliary in all gauge theories, and the system develops a richer structure of constraints. Unfortunately for most gauge theories, this limit turns out to be too singular to quantize and the theory ceases to be renormalizable. For a special class of gauge theories, however, where there are no fermions and there is only one multiplet of scalars in the adjoint representation, the author proves that a consistent renormalizable quantum theory exists even in this very singular limit. The author traces this exceptional behavior to a new local translationlike symmetry in the functional space that this class of gauge models possesses in the limit of infinite gauge coupling constant. By carrying out the constraint analysis, evaluating the Faddeev-Popov-Senjanovic determinant, and doing the functional integrations over the canonical momenta, the gauge fields, and most of the components of the scalar fields, the author obtains an extremely simple result with no non-Abelian structure left in it. For example, for group SU(2), the final answer reduces to the theory of a one-component self-interacting real ϕ^4 scalar field theory. Throughout the paper, the author uses functional methods and makes no approximations; the results are nonperturbative and exact. The author also discusses some of the possible implications of the results. (31 refs.)

65050 Surface terms and dual formulations of gauge theories. W.Mecklenburg, L.Mizrachi (Internat. Centre for Theoretical Phys., Trieste, Italy).
Phys. Rev. D (USA), vol.27, no.8, p.1922-31 (15 April 1983).
Previously proposed duality transformations for a pure non-Abelian gauge theory are carried out for a Yang-Mills theory with nonvanishing θ parameter. The authors argue that the theory is no longer self-dual even in the weak-coupling limit, as there is a surface term generated by the duality transformation. This surface term has nonzero Pontryagin index, hence it gets contributions from instanton-type configurations only. However, it does vanish for monopoles and vortices, therefore for this set of configurations self-duality is maintained in the weak-coupling region. (22 refs.)

65051 Convexity of the effective potential. R.W.Haymaker, J.Perez-Mercader (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1948-9 (15 April 1983).
The authors present a simple argument for the convexity of the effective potential $V(\phi)$. (7 refs.)

65052 Virial theorems for relativistic spin-$^1/_2$ and spin-0 particles. M.Brack (Inst. for Theoretical Phys., Univ. of Regensburg, Regensburg, Germany).
Phys. Rev. D (USA), vol.27, no.8, p.1950-3 (15 April 1983).
The authors derive virial theorems for relativistic particles which obey the Dirac or the Klein-Gordon equation and are bound in scalar- and/or vector-type potentials. (9 refs.)

65053 Quantization in the temporal gauge. Y.Kakudo (Dept. of Phys., Osaka Kyoiku Univ., Osaka, Japan), Y.Taguchi, A.Tanaka, K.Yamamoto.
Phys. Rev. D (USA), vol.27, no.8, p.1954-5 (15 April 1983).
It is pointed out that the validity of the canonical quantization procedure in the temporal gauge is very questionable. The quantization can be discussed only within the framework of the path-integral formalism. However, in that case, the vacuum is not an energy eigenstate. (3 refs.)

65054 Numerical studies of renormalization in SU(3) gauge theory in four dimensions. R.W.B.Ardill (Dept. of Maths., Royal Holloway Coll., Englefield Green, England), M.Creutz, K.J.M.Moriarty.
Phys. Rev. D (USA), vol.27, no.8, p.1956-9 (15 April 1983).
Wilson loops for pure SU(3) gauge theory are calculated by Monte Carlo simulations on an 8^4 lattice. Following renormalization-group arguments, Wilson loops on different length scales are compared. The only observed ultraviolet-stable fixed point lies at vanishing bare coupling. Asymptotic freedom is numerically verified. (7 refs.)

65055 Quasi-Abelian versus large-N_c linear confinement. S.L.Adler, H.Neuberger (Inst. for Advanced Study, Princeton, NJ, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1960-1 (15 April 1983).
In the quasi-Abelian approximation as well as in the large-N_c limit sources in the adjoint representation cannot be screened. Nevertheless, the two phenomena are different because the string tension is proportional to the square root of the Casimir operator in the first case and to the Casimir operator itself in the second. (8 refs.)

65056 Dirac equation revisited: charge quantization as a consequence of the Dirac equation. C.Radford (Dept. of Appl. Math., Univ. of Sydney, Sydney, New South Wales, Australia).
Phys. Rev. D (USA), vol.27, no.8, p.1970-1 (15 April 1983).
It is shown that the Dirac equation possesses an internal-symmetry group, which contains the usual electromagnetic gauge group. Well-known group-theoretical results then imply that charge is quantized. (8 refs.)

65057 The Wilson loop in a physical gauge. E.Guadagnini (Istituto di Fisica, Univ. of Pisa, Pisa, Italy).
Phys. Scr. (Sweden), vol.27, no.3, p.161-2 (March 1983).
The author determines the static potential between nonabelian charges at order g^4 by computing the Wilson loop, for a rectangular loop in the large-T limit. He uses a physical gauge obtained from the $A_0=0$ gauge by integrating over the longitudinal components of the vector potential. (5 refs.)

65058 Gauge theories of general form. P.M.Lavrov, I.V.Tyutin (Lenin Consomol Pedagogical Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.639-41 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.64-6 (July 1982). [received: May 1983]
The dependence of the unrenormalized effective action and the generating functional of vertex functions on canonical transformations is investigated in the paper, and the construction of the effective action in gauge theories of general form is described. (5 refs.)

65059 Polarization symmetry of vector fields. V.I.Strazhev, P.L.Shkol'nikov (Inst. of Mechanization of Agriculture, Belorussian SSR).
Sov. Phys. J. (USA), vol.25, no.7, p.652-5 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.77-80 (July 1982). [received: May 1983]
A group of additional invariance (polarization symmetry) of the Prock equations is considered, whose generators satisfy the algebra SU(3) (massive field) of SU(2) (massless field). The method of investigation developed in the paper is directly related to the physical content of the transformations of the symmetry being discussed: the change in the polarization field. The small Lorentz group is a sub-group of the transformations being discussed. Possible physical applications of polarization symmetry are discussed. (10 refs.)

65060 Low mass-scale parity restoration in expanded gauge theories. S.Rajpoot (Internat. Center for Theoretical Phys., Trieste, Italy).
Z. Phys. C (Germany), vol.17, no.3, p.259-63 (1983).
It is shown that schemes of grand unification with $SU(2n)^4$ gauge symmetry permit the embedding of the left-right symmetric $SU(2)_L \times SU(2)_R \times U(1) \times SU(3)^c$ intermediate symmetry at relatively low energies [between 250 GeV and a few TeV] as well as allows light unification mass-scales ($\leq 10^5$ TeV) if $n \geq 3$ for values of the weak angle $\mathrm{Sin}^2\theta_w$ and the strong coupling α_s in the ranges of $0.20 \leq \mathrm{Sin}^2\theta_w \leq 0.25$, $0.10 \leq \alpha_s \leq 0.15$. (13 refs.)

65061 Plasmon in the Coulomb gauge. T.Toimela (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).
Z. Phys. C (Germany), vol.17, no.4, p.365-6 (1983).
The non-perturbative plasmon contribution to the thermodynamic potential of the pure Yang-Mills theory is calculated in the Coulomb gauge. (11 refs.)

65062 Weak CP violation in a model with invisible axion. A.S.Joshipura (Indian Inst. of Technol. Kanpur, Kanpur, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.17
Weak CP violation in an $SU(2)_L \times U(1)_R \times U(1)_{PQ}$ model is considered. The extra global $U(1)_{PQ}$ is used to rotate away θ-term responsible for strong CP violation and also to label the fermionic generations in a manner proposed by Davidson and Wali. Flavour changing transitions caused by neutral Higgs scalars constitute a unique source of CP violations in the model. The ϵ parameter vanishes identically if the mass matrix M_d of down quarks is symmetric. The observed magnitude of ϵ can arise through exchange of Higgs scalar with mass around 1 TeV if M_d has a small antisymmetric part. The resulting theory is of microweak type.

65063 Mass generation of spin 3/2 fields in supersymmetric models. P.Dasgupta (Univ. of Kalyani, Kalyani, India), P.Pal.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.21
The problem of a massless spin 3/2 field acquiring mass through spontaneous symmetry breaking is studied in a supersymmetric model containing a Rarita-Schwinger and a vector field coupled suitably to a spin 1/2-spin O multiplet. A simple analysis is presented to show how supersymmetry transformations play a crucial role in ensuring consistency in such a theory. When gravitation is sought to be introduced through local supersymmetry, a stringent condition must be imposed on the Lagrangian to let the mechanism work and a new problem of consistency arises.

65064 Validity of Adler Bardeen theorem in a supersymmetric U(1) gauge model. B.Vijayalakshmi (Dept. of Theoretical Phys., Univ. of Madras, Madras, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.22
The supermultiplet structure exhibited by the axial vector current $j_\mu{}^5$, the improved energy momentum tensor $\Theta_\mu{}^\nu$ and the supercurrent S_μ, in supersymmetric gauge theories, has led many authors to believe that the axial vector anomaly picks up radiative corrections. It is of interest to see under what conditions renormalisability can be restored. The author studies a supersymmetric U(1) gauge model in which the total anomaly is zero at the lowest order, the radiative corrections to these lower order graphs coming from each fermion loop turn out to be zero. The author indicates how this result can be extended to non-Abelian gauge theories. This result has significant implications to the question of renormalisability of supersymmetric grand unified models which are not left-right symmetric.

65065 Absence of quadratically divergent mass corrections in supersymmetric spontaneously broken U(1) gauge theories. T.R.Govindarajan (Dept. of Phys., India Inst. of Technol., Kanpur, India), R.K.Kaul, B.Vijayalakshmi.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.23
It is shown that in N=1 supersymmetric spontaneously broken U(1) gauge theories the Fayet Illioupoulos D term gets only logarithmically divergent corrections, when the traces of U(1) is arranged to be zero.

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Planar rotor: The θ-vacuum structure, and some approximate methods in quantum mechanics .... See Entry 64753

Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2) .... See Entry 64783

Eigenvalues of the Chandrasekhar-Page angular functions .... See Entry 64804

Geometrical interpretation of a generalized theory of gravitation .... See Entry 64811

The gauge treatment of gravity .... See Entry 64812

Gauging of d=11 supergravity? .... See Entry 64813

Local symmetries in extended conformal gravity and conformal supergravity in superspace .... See Entry 64814

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11.20 S-MATRIX THEORY

65066 Local *S*-matrix symmetries in Galilean field theories. W.-D.Garer (Inst. fur Theoretische Phys., Univ. of Gottingen, Gottingen, Germany).
J. Math. Phys. (USA), vol.24, no.5, p.1256-63 (May 1983).
A symmetry of the *S*-matrix is an operator that commutes with *S* and is additive, i.e. transforms an incoming *n*-particle state as a sum of its constituent one-particle states. For field theories with the Galilei group as a symmetry group and with nonvanishing elastic two-particle scattering amplitude, all *x*-matrix symmetries *Q* are determined that are local, i.e. transform local asymptotic fields into local ones. For scalar fields, *Q* is a linear combination of the ten generators of the Galilei group *G*, internal symmetries, and, possibly, two other generators *C* and *D*. By Galilean invariance, the generators of *G* are *S*-matrix symmetries in all field theories. In contrast, it depends on the specific field theory if *C* and *D* occur. If *C* is a symmetry, then *D* is, too, and vice versa. All scattering amplitudes are given that admit *C* and *D* as *S*-matrix symmetries. (29 refs.)

65067 Finitely many symmetries of the *S*-matrix. W.-D.Garber (Inst. fur Theoretische Phys., Univ. Gottingen, Gottingen, Germany).
J. Math. Phys. (USA), vol.24, no.5, p.1264-6 (May 1983).
S-matrix symmetries are operators that commute with the *S*-matrix and act additively on incoming *n*-particle states. For relativistic field theories, the structure of such symmetries is known if they arise from a local, conserved current density. In this paper it is shown that the same structural result is obtained if a relativistic field theory with finitely many but possibly nonlocal *S*-matrix symmetries is considered. (9 refs.)

65068 The partial-wave projected Coulomb *T* matrix for all *l* in closed hypergeometric form. H.van Haeringen (Dept. of Math., Delft Univ. of Technol., Delft, Netherlands).
J. Math. Phys. (USA), vol.24, no.5, p.1267-73 (May 1983).
The author obtains relatively simple closed expressions for the partial-wave projections of the off-shell Coulomb *T* matrix in the momentum representation, $\langle p|T_{cl}(k^2)|p'\rangle$, for all $l=0, 1, 2, \ldots$. These exact analytic expressions consist of three parts: (i) $\mathcal{F}_l$, simple combinations of the Jacobi polynomial $P_l^{(i\gamma,-i\gamma)}$ and the hypergeometric function ${}_2F_1(1,i\gamma;\ 1+i\gamma;.)$, with different arguments [γ is Sommerfeld's parameter; the Coulomb potential is $V_c(r)=2k\gamma/r$]; (ii) a polynomial $\mathcal{E}_l$; and (iii) $\mathcal{L}_l$=a polynomial times ln $[(p+p')^2/(p-p')^2]$. The polynomials under (ii) and (iii) are given in terms of the Jacobi polynomials $P_l^{(m,-m)}$, $m=01, 1, \ldots, l$. The author derives interesting relations, especially valuable for the theory of off-shell Coulomb scattering, and presents simple closed expressions for the special cases $l=0$, 1, and 2; $p' \to k$, $p' \to \infty$, and $\gamma \to 0$. (16 refs.)

65069 On a generalized F. Riesz problem. P.Dita (Inst. for Phys. & Nuclear Engng., Bucharest, Rumania).
J. Math. Phys. (USA), vol.24, no.5, p.1282-5 (May 1983).
The description of the pion-pion partial waves which are analytic and crossing symmetric is equivalent to solving a generalized Riesz problem (1920). A continuous family of solutions of this problem is constructed. (8 refs.)

On the complex angular momentum theory of scattering .... See Entry 65078

11.30 SYMMETRY AND CONSERVATION LAWS

(see also 02.20 Group theory)

65070 SU(2)×SU(2) shift operators and representations of SO(5). J.W.B.Hughes (Dept. of Appl. Math., Queen Mary Coll., London, England).
J. Math. Phys. (USA), vol.24, no.5, p.1015-20 (May 1983).
SU(2)×SU(2) shift operators analogous to the SU(2) shift operators developed and used by the author (1978) for the classification and analysis of representations of Lie algebras in an SU(2) or SO(3) basis are obtained for the SU(2)×SU(2) Lie algebra in the case where one has an additional set of operators forming an irreducible four-dimensional tensor representation of SU(2)×SU(2). The shift operators obtained are used to treat the representations of SO(5) in an SU(2)×SU(2) basis. (25 refs.)

65071 Nonscalar extension of shift operator techniques for SU(3) in an O(3) basis. III. Shift operators of second degree in the tensor components. J.Van der Jeugt, H.E.De Meyer, G.Vanden Berghe (Rijksuniv. Gent, Gent, Belgium).
J. Math. Phys. (USA), vol.24, no.5, p.1025-31 (May 1983).
For pt.II see ibid., vol.22, p.2366 (1981). Shift operator $Q^k{}_l$ $(-2 \leq k \leq 2)$ of second degree in the tensor components q_μ $(-2 \leq \mu \leq 2)$ are constructed. Relations connecting quadratic shift operator products of the type $O^j{}_{l+k}Q^k{}_l$ or $Q^k{}_{l+j}O^j{}_l$, and of the type $Q^j{}_{l+k}Q^k{}_l$ are derived. The usefulness of these relations is demonstrated by the example of the $O^0{}_l$- and $Q^0{}_l$-eigenvalue calculation for various irreducible representations (p,q) of SU(3). (10 refs.)

65072 Indecomposable representations for para-Bose algebra. B.Gruber (Phys. Dept., Southern Illinois Univ., Carbondale, IL, USA), T.S.Santhanam.
J. Math. Phys. (USA), vol.24, no.5, p.1032-6 (May 1983).
A general study of the representations of the graded Lie algebra of para-Bose oscillators is given. Besides realizing the standard representations, the authors also find some interesting indecomposable (not fully reducible) representations. (10 refs.)

65073 Minimal electromagnetic coupling schemes. I. Symmetries of potentials and gauge transformations. J.Beckers, V.Hussin (Inst. de Phys. au Sart Tilman, Univ. de Liege, Liege, Belgium).
J. Math. Phys. (USA), vol.24, no.5, p.1286-94 (May 1983).
Minimal electromagnetic coupling schemes entering into Klein-Gordon or Schrodinger equations are studied in connection with symmetries inside and outside the symmetry groups of the corresponding free equations. Subsymmetries of relativistic potentials are classified up to conjugacy under the kinematical groups of the associated (constant and uniform) electromagnetic fields. Through invariance conditions on (physical) four-potentials a maximal character of the symmetry is obtained leading to the maximal symmetry groups of the corresponding wave equations with interaction. Usual and compensating gauge transformations are analyzed within the context of such invariance conditions applied to arbitrary electromagnetic fields. (22 refs.)

65074 Generalized Hooke groups and the mass-spectrum problem. D.Beau (Phys.-Math., Faculte des Sci. Mirande, Dijon, France).
J. Math. Phys. (USA), vol.24, no.5, p.1299-310 (May 1983).
The author briefly recalls the notion of internal structure and the relativistic covariant method [introduced in Beau and Horchani, J. Math. Phys.20, 1700 (1979)] of unifying external and internal structures leading to a kinematical Lie algebra. In this framework the author proposed a concept of dynamical development of the physical systems defined by this Lie algebra. So he obtains some Lie algebras, a generator of which (the Hamiltonian) gives rise to various mass formulas capable of describing the hadron spectrum; he makes use of both unitary global representations and partially integrable Schur-irreducible symmetric load representations. (26 refs.)

65075 Mass splitting between the supersymmetric partners of quarks and leptons. T.K.Kuo, N.Nakagawa (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.560-2 (23 April 1983).
It is shown that superpartners of the matter fields induce significant corrections to the mass of W-bosons and hence also the value of the ρ-parameter. As a result, an upper bound $\Delta m \lesssim 100$ GeV is obtained for mass splittings among members of the SU_2-doublet smatters. (8 refs.)

65076 Transformation coefficients between SO(6) and SU(4) Gelfand-Zetlin states. Yu Zu-rong (Nanjing Univ., Nanjing, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.121-5 (Jan. 1983). In Chinese.
Gives a method of calculating the transformation coefficients between SO(6) and SU(4) Gelfand-Zetlin states. (7 refs.)

65077 Charmed baryon magnetic moments in broken SU(8) model. C.P.Singh, K.P.Tiwari (Dept. of Phys., VSSD Coll., Kanpur, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.19
The magnetic moments of charmed baryons are studied in the broken SU(8) frame work. By including the additional symmetry breaking effects due to quark masses, the moments are calculated and compared with other formalisms.

5th High Energy Spin Symposium See Entry 64572

Illustrative examples of the symplectic group See Entry 64624

Transfer matrices for one-dimensional potentials See Entry 64729

Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2) See Entry 64783

A simplified derivation of the Geroch group in two-dimensional reduced gravity See Entry 64792

The gauge treatment of gravity See Entry 64812

Local symmetries in extended conformal gravity and conformal supergravity in superspace See Entry 64814

Efficient implementation of the Monte Carlo method for lattice gauge theory calculations on the floating point systems FPS-164 See Entry 65012

Decay of the false vacuum at finite temperature See Entry 65014

A lagrangian formulation of the Wess approach to supersymmetric Yang-Mills theories See Entry 65015

The quantum mechanical supersymmetric O(3) and O(2,1) σ-models See Entry 65016

Renormalization-group analysis of supersymmetric mass hierarchies See Entry 65017

Orbit space and minima of Landau-Higgs potentials See Entry 65023

On the generalization of the 't Hooft field strength in the Yang-Mills-Higgs model See Entry 65027

Group-theoretical analysis of the sine-Gordon equation as a relativistic dynamical system See Entry 65029

Lorentz transformation properties of nonconserved charges See Entry 65030

Minimal electromagnetic coupling schemes. II. Relativistic and nonrelativistic Maxwell groups See Entry 65038

Co-ordinates for fermions See Entry 65040

Some remarks on the symmetry algebras of soliton equations See Entry 65042

Hadron spectrum, spontaneous breaking of Z(3) and fake loops in lattice SU(3) See Entry 65043

Class of very simple gauge theories which remain renormalizable even in the limit of infinite gauge coupling constant See Entry 65049

Surface terms and dual formulations of gauge theories See Entry 65050

Numerical studies of renormalization in SU(3) gauge theory in four dimensions See Entry 65054

Polarization symmetry of vector fields See Entry 65059

Low mass-scale parity restoration in expanded gauge theories See Entry 65060

Weak CP violation in a model with invisible axion See Entry 65062

Mass generation of spin 3/2 fields in supersymmetric models See Entry 65063

Validity of Adler Bardeen theorem in a supersymmetric U(1) gauge model See Entry 65064

Absence of quadratically divergent mass corrections in supersymmetric spontaneously broken U(1) gauge theories See Entry 65065

Spontaneous gauge symmetry breaking in nonminimal supersymmetric grand unified theories See Entry 65079

Neutron oscillations in a periodically varying magnetic field See Entry 65081

Non-abelian conformal gravity as the origin of strong interactions See Entry 65082

Classical upper bounds for grand-unified monopole masses See Entry 65083

Generalized projection matrices for nonsupersymmetric and supersymmetric grand unified theories See Entry 65085

An SU(4)⊗SU(2)⊗U(1) unified model See Entry 65086

A comment on the light-fermion mass hierarchy problem in SU(9) grand unified models See Entry 65087

Fermions in the SU(5) colorless dyon field See Entry 65088

Unified theory of weak, strong, and electromagnetic interactins: spontaneous breaking of the symmetry of a vacuum See Entry 65089

Geometric hierarchy for the supersymmetry breaking scale See Entry 65091

Breaking of manifest left-right symmetry in SO(10) GUTs See Entry 65092

Cabibbo mixing, natural flavour conservation and CP violation in a left right symmetric electroweak gauge model with horizontal symmetry. See Entry 65094

Asymmetry parameters in the polarized e-p and e-d scattering within the framework of $SU(2)_L \times U(1) \times U(1)$ and SO(10) gauge models See Entry 65095

n-n̄ oscillations in SU(5) GUT and left-right asymmetry See Entry 65096

Do mass scales for observable parity restoration and n-n̄ oscillation exist in SU(16): See Entry 65097

A new subtraction procedure for GUTs and mass scales for parity restoration and n-n̄ oscillation in SO(10) See Entry 65098

Supersymmetry breaking in three dimensions See Entry 65099

Spin physics and inclusive processes at short distances See Entry 65109

Spin effects in large angle two body reactions at high energy See Entry 65111

Electromagnetic quark mass difference and dynamical symmetry breaking See Entry 65125

Couplings of heavy flavour particles from QCD sum rules See Entry 65128

Nuclei as metabags See Entry 65130

Measurement of the polarization of positive muons produced in high-energy antineutrino interactions See Entry 65143

Formation and signature of quark matter in relativistic ion collisions: evidence from cosmic rays See Entry 65227

Investigation of parity violation in ^{19}F See Entry 65230

11.40 CURRENTS AND THEIR PROPERTIES

Validity of Adler Bardeen theorem in a supersymmetric U(1) gauge model See Entry 65064

11.50 DISPERSION RELATIONS AND SUM RULES

On a generalized F. Riesz problem See Entry 65069

General infrared and ultraviolet properties of the gluon propagator in the axial gauge See Entry 65115

Meson widths and form factors at intermediate momentum transfer in nonperturbative QCD See Entry 65121

Couplings of heavy flavour particles from QCD sum rules See Entry 65128

Moments of definite signature in lepton-hadron scattering and their right signature points See Entry 65153

11.60 COMPLEX ANGULAR MOMENTUM; REGGE FORMALISM

(see also 03.80 General theory of scattering, 12.40M in strong interactions)

65078 On the complex angular momentum theory of scattering. K.-E.Thylwe (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
J. Phys. A (GB), vol.16, no.6, p.1141-53 (21 April 1983).
A contribution to the theory of complex angular momentum techniques in the field of atomic and molecular collisions is given. The author derives a new, flexible representation of the scattering amplitude on the basis of realistic assumptions for the behaviour of the *S*-matrix in the complex angular momentum plane. The representation has the form of a sum of steepest-descent integrals, *S*-matrix residue terms and a symmetry-type background integral. The flexibility is due to the presence of two integer parameters which may be chosen conveniently so as to make the residue sums sufficiently convergent and to minimise the total number of important terms. (20 refs.)

12.00 SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received) See Entry 64598

12.10 UNIFIED FIELD THEORIES AND MODELS

65079 Spontaneous gauge symmetry breaking in nonminimal supersymmetric grand unified theories. J.Kubo, S.Sakakibara (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
J. Phys. G (GB), vol.9, no.5, p.475-96 (May 1983).
In supersymmetric grand unified theories with the unified group larger than SU(5), it is required that gauge symmetry is spontaneously broken down to

the effective-low-energy group $SU(3)_c \times SU(2)_w \times U(1)\gamma$ without breaking supersymmetry. After studying some possible symmetry-breaking patterns which are realised by combinations of Higgs superfields in some lower-dimensional representations, the authors apply the results to several examples with the unified groups SU(6), SU(7) and SO(10). (41 refs.)

65080 Fermion-induced monopole-antimonopole annihilation. A.F.Grillo, Y.Srivastava (Lab. Nazionali, Istituto Nazionale di Fisica Nucleare, Frascati, Italy).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.579-82 (23 April 1983).
Monopole-antimonopole annihilation is reconsidered taking into account the peculiar behaviour of the baryon-number-violating monopole interactions. The authors review the problem of cosmological monopole abundance which can be (almost) solved without reference to inflation or more radical alternatives. (6 refs.)

65081 Neutron oscillations in a periodically varying magnetic field. G.D.Pusch (Phys. Dept., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.149-58 (21 March 1983).
Transforms the driven-neutron-oscillation problem into a form similar to a magnetic-resonance problem in an internal space, and obtain an approximate analytical solution in the neighbourhood of the resonances. The results are in good agreement with the numerical work of Arndt, Prasad and Riazuddin (1981). The author finds that the n̄ probability is quite insensitive to variations in magnetic-field strength and driving frequency when near a resonance maximum, the only critical aspect being the alignment between the static and oscillating fields. (18 refs.)

65082 Non-abelian conformal gravity as the origin of strong interactions. H.Saller (Max-Planck-Inst. fur Phys. & Astrophys., Werner-Heisenberg-Inst. fur Phys., Munich, Germany).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.159-75 (21 March 1983).
A metric tensor of gravity originating as a composite structure from basic spinor fields naturally carries also the internal symmetry properties of the underlying spinor fields. The closeness of the grand-unification breakdown mass to Planck's mass suggests an interpretation of the strong lepton-quark symmetry, e.g. SU_4, as an internal group also relevant for the dilatation. Spontaneous breakdown of dilatation and lepton-quark symmetry are closely related. Indefinite metric, dangerous for energies of the order of Planck's mass, seems to be an unavoidable consequence of a spontaneous dilatation breakdown. (15 refs.)

65083 Classical upper bounds for grand-unified monopole masses. A.N.Schellekens, C.K.Zachos (Fermi Nat. Accelerator Lab., Batavia, Il, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1242-5 (25 April 1983).
In addition to being bounded from below by the Prasad-Sommerfield limit, monopole masses are also bounded from above by the limit in which the scalar field variables are frozen to their vacuum values. This upper bound is close to the lower one: the single-, double-, and triple-strength SU(5) monopoles are found to have their masses bound in $m \leq M \leq m \times 1.7867$, $2m \leq M \leq 2m \times 2.0741$, and $3m \leq M \leq 3m \times 2.3155$, respectively, where $m = 3M_x/8\alpha$. (16 refs.)

65084 Neutrinoless double beta decay in the case of Dirac neutrinos. K.Enqvist (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland), J.Maalampi, K.Mursula.
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.89-93 (21 April 1983).
The possibility of generating neutrinoless double beta decay with Dirac neutrinos is discussed. Two scenarios with very different signatures are presented, one with a left-handed and the other with a right-handed lepton number violating electron-neutrino interactions. An example of a gauge model with the latter kind of coupling is given. (10 refs.)

65085 Generalized projection matrices for nonsupersymmetric and supersymmetric grand unified theories. Chang-Ho Kim, In-Gyu Koh, Young-Jai Park, Kee Yong Kim, Yongduk Kim (Dept. of Phys., Sogang Univ., Seoul, Korea).
Phys. Rev. D (USA), vol.27, no.8, p.1932-44 (15 April 1983).
The authors obtain the generalized projection matrices which can easily generate subalgebras and their representations of a simple Lie algebra for all classical groups of arbitrary ranks. In contrast to the nonsupersymmetric grand unified theories, all the real groups and representations can be candidates in the supersymmetric grand unified theories. Also they explicitly include all possible U(1) factors which are crucial in nonsupersymmetric and supersymmetric grand unified theories. (21 refs.)

65086 An SU(4)⊗SU(2)⊗U(1) unified model. Xu De-zhi (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.13-19 (Jan. 1983). In Chinese.
Proposes an $SU(4) \otimes SU(2) \otimes U(1)$ unified model, in which the stratons and leptons of every generation belong to the same multiplet, and the leptons will couple to the the stratons. However, this kind of coupling cannot cause the proton decay, and has only some effects in high energy scattering. This model predicts the existence of two neutral intermediate bosons, instead of one, and the value of Weinberg angle to be $\sin^2\theta_w = 0.25$. The neutrinos have reasonable masses in the model. (6 refs.)

65087 A comment on the light-fermion mass hierarchy problem in SU(9) grand unified models. Dong Fang-xiao, Tu Tung-sheng, Xue Pei-you (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.20-7 (Jan. 1983). In Chinese.
According to the idea of Barr (1980) for solving the light-fermion mass hierarchy problem, all possible $SU(9)$ grand unified models are systematically examined. The conclusion is negative, there is no hope of realizing the $(\alpha^2, \alpha, 1)$ pattern in $SU(9)$ models. (5 refs.)

65088 Fermions in the SU(5) colorless dyon field. Ma Zhong-Qi (Inst. of High Energy Phys., Acad. Sinica, Peking, China), Tang Ju-fei.
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.35-41 (Jan. 1983). In Chinese.
The Prasad-Sommerfield-like, colorless and finite-mass dyon analytic solution in $SU(5)$ ground unified model is found. It is the only physical dyon solution so far. In the $SU(5)$ model the Dirac equation of fermions in the dyon field is derived concretely, and the mathematical method for solving the equation is pointed out and discussed. (19 refs.)

65089 Unified theory of weak, strong, and electromagnetic interactins: spontaneous breaking of the symmetry of a vacuum. A.N.Kushnirenko (Inst. of Problems in Materials Sci., Acad. of Sci., Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.7, p.659-63 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.84-8 (July 1982). [received: May 1983]
It is shown that the presence of the additional symmetry discussed (1982) induces additional gauge fields, which can be held responsible for strong interactions of nucleons. In the spontaneous breaking of the symmetry of a vacuum the particles corresponding to these fields acquire masses. The masses are estimated. It is noted that in a special case the given theory goes over to the Weinberg-Salam theory describing weak and electromagnetic interactions of leptons. (2 refs.)

65090 Proton decay in terms of an effective baryon-lepton transition. W.Lucha, H.Stremnitzer (Inst. fur Theoretische Phys., Univ. Wien, Wein, Austria).
Z. Phys. C (Germany), vol.17, no.3, p.229-42 (1983).
The authors calculate the two-body decay rates for the hadronic and electromagnetic decays of proton and neutron in terms of the effective baryon-lepton transition matrix element. Further ingredients like PCAC and vector meson dominance are used. They compute these transition amplitudes within the framework of a relativistic quark model involving Bethe-Salpeter amplitudes and present the nucleon lifetimes and branching ratios of various decay modes for three different grand unification models. (53 refs.)

65091 Geometric hierarchy for the supersymmetry breaking scale. C.Oakley, G.G.Ross.
Report RL-83-012, Rutherford Appleton Lab., Chilton, Oxon., England (Jan. 1983), 10 pp.
Considers F type supersymmetry breaking through O'Raifeartaigh-Fayet potentials. It is shown how a class of models gives rise to a supersymmetry breaking scale reduced relative to the fundamental scale M of the potential by powers of (M/M_{Planck}). The role of R invariance in such potentials is discussed. (12 refs.)

65092 Breaking of manifest left-right symmetry in SO(10) GUTs. A.Raychaudhuri (Dept. of Pure Phys., Univ. of Calcutta, Calcutta, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.15
The intriguing possibility of low energy restoration of parity requires the right-handed weak gauge bosons to be light. For this scenario to be consistent with the K_L-K_S mass difference the Cabibbo angles in the left- and the right-handed sectors have to be different. SO(10) is the smallest grand unifying group that can accomodate left-right symmetry. Fermion mass generation in SO(10) through Yukawa couplings is examined for an acceptable breaking of manifest left-right symmetry without disturbing the proper lepton mass spectrum predictions.

65093 Resolution of compositeness of Higgs bosons. R.M.Godbole (Inst. of Sci., Bombay, India), P.Roy.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.16
The ZHZ vertex in the W-S model will have a structure if the Higgs boson were composite. The presence of such a structure can be detected by doing an experimental analysis of the muon pair mass distribution in $e^+e^- \rightarrow Z \rightarrow H\mu^+\mu^-$ (for a Higgs boson mass between 10 GeV and 40 GeV).

65094 Cabibbo mixing, natural flavour conservation and CP violation in a left right symmetric electroweak gauge model with horizontal symmetry.. A.K.Ray, K.K.Kundu, K.Niyogi (Dept. of Phys., Visva-Bharati Univ., Santiniketan, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.18
Cabibbo mixing for a two generation model of quarks based on the gauge group $SU(2)_L \times SU(2)_R \times U(1) \times U(1)$ with a proper choice of the Higgs constant is discussed. The model leads to natural flavour conservation if a suitable discrete symmetry is introduced. CP violation arises through Kobayashi-Masakara mechanism as well as Higgs exchange, which in some situations is solely responsible for CP violation.

65095 Asymmetry parameters in the polarized e-p and e-d scattering within the framework of $SU(2)_L \times U(1) \times U(1)$ and SO(10) gauge models. M.Kundu, K.Niyogi, A.K.Ray, B.Talukdar (Dept. of Phys., Visva-Bharati Univ., Santiniketan, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.20
The predictions of $SU(2) \times U(1) \times U(1)$ and SO(10) gauge models for the asymmetry parameters A^-, B^-, C_L and C_R in the deep inelastic scattering of polarized electrons and positrons by unpolarized protons and deuterons are compared with those calculated in the Weinberg Salam model for different values of y.

65096 n-n̄ oscillations in SU(5) GUT and left-right asymmetry. U.Sarkar (Dept. of Pure Phys., Univ. of Calcutta, Calcutta, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.25
The minimal theory for unifying the strong, weak and electromagnetic interactions is the grand unified theory based on the gauge group SU(5). This theory cannot accommodate within itself left-right symmetry. Here the left-right asymmetry is reflected in, among other things, n-n̄ oscillations with left-handed and right-handed particles. In both cases, a nonminimal Higgs sector is necessary. However, for the n-n̄ oscillations with left-handed particles a Higgs scalar with hypercharge $Y=2$ must acquire VEV in addition to the minimal Higgs scalars already present in the theory. But for the n-n̄ oscillations with right-handed particles no nonminimal Higgs needs to acquire VEV.

65097 Do mass scales for observable parity restoration and n-n̄ oscillation exist in SU(16):. M.K.Parida (Post-Graduate Dept. of Phys., Sambalpur Univ., Sambalpur, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.26
A subtraction procedure proposed earlier for GUTs, which seems to be essential for a correct application of extended survival hypothesis, is used to search for intermediate mass scales for parity restoration and n-n̄ oscillation in SU(16) grand unification scheme. It is found that in two different chains, where the left-right symmetry is broken at a lower mass scale than the quark-lepton symmetry, low-mass (~100 GeV) parity restoration is allowed for $\sin^2\Theta_W \simeq .235$, but without observable n-n̄ or H-H oscillations. In a third chain where left-right symmetry is broken at a higher mass scale, observable n-n̄ and H-H oscillations and proton decay are allowed for $\sin^2\Theta_W \simeq .235$ along with a right-handed neutral boson mass around 100 GeV.

65098 A new subtraction procedure for GUTs and mass scales for parity restoration and n-n̄ oscillation in SO(10). M.K.Parida (Post-Graduate Dept. of Phys., Sambalpur Univ., Sambalpur, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.27
While calculating the Higgs contributions to the evolution of coupling constants in grand unified theories (GUTs) using extended survival hypothesis, the use of a new subtraction procedure is essential for a correct application of the hypothesis. When applied to two different chains of symmetry breaking of SO(10), where $G' \equiv SU(2)_R X U(1)_{B-L}$ is broken, but at mass scales lower than the quark-lepton-unification mass (M_X), low-mass parity restoration around 100 GeV is allowed.

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received) .... See Entry 64598

Decay of the false vacuum at finite temperature .... See Entry 65014

Renormalization-group analysis of supersymmetric mass hierarchies .... See Entry 65017

Low mass-scale parity restoration in expanded gauge theories .... See Entry 65060

Transformation coefficients between SO(6) and SU(4) Gelfand-Zetlin states .... See Entry 65076

Electrically neutral quarks: production of fractionally charged hadrons .... See Entry 65122

Radiative corrections to Higgs production by $e^+e^- \rightarrow ZH$ in the Weinberg-Salam model .... See Entry 65140

Electroweak effects in $e^+e^- \rightarrow \mu^+\mu^-$ at 29 GeV .... See Entry 65142

Spin asymmetries in W and Z production at pp and p̄p colliders .... See Entry 65184

Spin asymmetries in large P_T production of lepton pairs in the collision of polarized hadrons .... See Entry 65197

Effect of neutrino-oscillations on the fluxes of atmospheric neutrinos .... See Entry 69460

The early Universe and high-energy physics .... See Entry 69770

12.20 MODELS OF ELECTROMAGNETIC INTERACTIONS

Gauge differential form theories on the lattice .... See Entry 65021

12.20D Specific calculations and limits of quantum electrodynamics

65099 Supersymmetry breaking in three dimensions. C.P.Burgess (Center for Theoretical Phys., Univ. of Texas, Austin, TX, USA).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.459-68 (2 May 1983).
One-loop corrections to the effective potential in three-dimensional supersymmetric massless scalar electrodynamics are calculated to see whether or not they spontaneously break supersymmetry. It is found that neither the supersymmetry nor the U(1) gauge invarance is broken by one-loop effects. (6 refs.)

65100 The discovery of a magnetic monopole and its implication for quarks. L.H.Ryder (Phys. Lab., Univ. of Kent, Canterbury, England).
Eur. J. Phys. (GB), vol.3, no.4, p.206-9 (1982).
Concerns the recent claim to have discovered a magnetic monopole by observing a change in the flux trapped in a superconducting ring. It is shown, in simple terms, how to calculate the magnetic charge in this type of event. Dirac's quantisation condition, according to which the product of any electric and any magnetic charge is quantised, is derived, and it then follows immediately that the magnetic charge which has been observed only satisfies Dirac's condition if it is the electron that has the 'fundamental' electric charge; the possibility that quarks carry the fundamental charge is ruled out. (5 refs.)

65101 A new approach to the conformal invariance problem in quantum electrodynamics. M.Ya.Palchik (Inst. of Automation & Electrometry, Acad. of Sci., Novosibirsk, USSR).
J. Phys. A (GB), vol.16, no.7, p.1523-7 (11 May 1983).
A formulation of conformal-invariant quantum electrodynamics is suggested, in which new representations of the conformal group are used. This results in unusual laws for the electromagnetic potential and the transverse part of the current, and modified expressions are obtained for the vertex and three-point Green function. The program of the asymptotic charge calculation within the frames of conformal-invariant skeleton theory is formulated. (7 refs.)

65102 Dirac-bracket formulation of QED in the superaxial gauge. H.J.Rothe, K.D.Rothe (Inst. fur Theoretische Phys., Univ. Heidelberg, Heidelberg, Germany).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.129-48 (21 March 1983).
Presents a Hamiltonian formulation of QED in a completely fixed axial gauge using the Dirac-bracket formalism. The authors achieve this by starting from a first-order Lagrangian where $F^{\mu\nu}$, A^μ, ψ and ψ^+ are considered to be the dynamical variables. In this formulation the dynamics of the system is subject to a large number of constraints. In fact, QED in the axial gauge already provides a very nontrivial example for the application of the Dirac-bracket formalism that leads to field commutators which, in contrast to previous attempts made by other authors, are consistent with the required asymptotic properties of the fields. Furthermore, starting from this Hamiltonian formulation, they derive the corresponding path integral representation for the generating functional in terms of the co-ordinate fields. (10 refs.)

65103 One-loop renormalisation of Coulomb-gauge QED. G.S.Adkins (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1814-20 (15 April 1983).
The author presents a physically motivated renormalisation scheme for Coulomb-gauge QED. This scheme is useful in calculations involving QED bound states. He implements this scheme to one loop by calculating the electron self-energy, the electron self-mass, and the renormalisation constants Z_1 and Z_2. Formulas for the dimensional regularisation of some noncovariant integrals useful in one-loop Coulomb-gauge calculations are given. (5 refs.)

65104 Transverse vertex and gauge technique in quantum electrodynamics. J.E.King (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1821-9 (15 April 1983).
It is known that the Schwinger-Dyson equation for the electron propagator $S(p)$ in quantum electrodynamics is linear if the full vertex in this equation is approximated by a special form (the longitudinal vertex) which satisfies the Ward identity and which yields exact results in the infrared regime. However, the approximate equation cannot be multiplicatively renormalised (nor is it properly gauge covariant) using only the longitudinal vertex. In the present work, the author constructs a transverse (i.e. identically conserved) vertex which, when added to the longitudinal vertex, yields an equation for $S(p)$ which remains linear and exact in the infrared, but which is multiplicatively renormalisable and gauge covariant. In the ultra-violet regime, the equation gives the known results of renormalisation-group-improved perturbation theory. The essential difficulty which is overcome by the present analysis is that of overlapping divergences, which are mishandled if only the longitudinal vertex is kept. (11 refs.)

65105 Landau's asymptotic solution of the vertex function in QED. E.B.Manoukian (Dept. of Nat. Defence, Royal Military Coll. of Canada, Kingston, Ontario, Canada).
Phys. Rev. D (USA), vol.27, no.8, p.1945-7 (15 April 1983).
The author considers finite massless QED with the electron mass totally dynamical of origin and the fine-structure constant as the (infinite order) zero of the Callan-Symanzik function. In spacelike regions, the electron propagator (in the generalized Landau gauge) and the photon propagator are then proportional to their free counterparts, and the integral equation for the vertex function Γ_σ may be written solely as a function of Γ_σ itself. Landau's approximation is used to obtain the asymptotics for $\Gamma_\sigma(p,p-k;k)$ for $p^2,k^2 \rightarrow \infty$, $p^2/k^2 \rightarrow 0$ in spacelike regions. (8 refs.)

65106 Green function of an electron and a scalar particle in external electromagnetic fields of special form. I.A.Khokhlov (Tomsk Medical Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.634-8 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.59-63 (July 1982). [received: May 1983]
Using the results of Khokhlov (1982), the relation between Green functions of an electron and a scalar particle in external electromagnetic fields of the following structure is investigated: $H=[n \times E]+H_3 n$, where n is a constant unit vector. The causative Green functions of an electron and a scalar particle are found in a field which is a combination of a longitudinal electric wave and a plane wave propagating in a single direction (along n). (11 refs.)

Particle states and scattering theory in abelian gauge model with spontaneously broken symmetry .... See Entry 65025

On the generalization of the 't Hooft field strength in the Yang-Mills-Higgs model .... See Entry 65027

Nonperturbative approach to the infrared behaviour in physical charged sectors of gauge theories .... See Entry 65046

Fermions in the SU(5) colorless dyon field .... See Entry 65088

Monte Carlo simulation of radiative corrections to the processes $e^+e^- \rightarrow \mu^+\mu^-$ and $e^+e^- \rightarrow q\bar{q}$ in the Z_0 region .... See Entry 65139

Production of a pseudoscalar meson with a lepton-antilepton pair in e^+e^- collisions .... See Entry 65141

12.25 MODELS FOR GRAVITATIONAL INTERACTIONS

(see also 04.60 Quantum theory of gravitation)

65107 Interaction of a spin-1/2 tachyon with a spin-1/2 bradyon and a tachyon-bradyon model. S.K.Srivastava (Government Coll., Port Blair, India).
J. Math. Phys. (USA), vol.24, no.5, p.1311-16 (May 1983).
Interaction of a spin-1/2 tachyon with the gravitational field of a spin-1/2 bradyon is investigated in the background of Schwarzschild geometry. A tachyo-bradyon bound system (PTBBS) is proposed. In PTBBS, a tachon revolves around a bradyon in a circular orbit. It is found that as the tachyon goes away from the bradyon, it emits energy under a certain condition; but if this condition is not satisfied, the tachyon gains energy while going away from the bradyon. Also, PTBBS is compared with Bohr's hydrogen atom model. In the end, the possibility of formation of PTBBS is discussed. (9 refs.)

12.30 MODELS OF WEAK INTERACTIONS

Breaking of manifest left-right symmetry in SO(10) GUTs .... See Entry 65092

Resolution of compositeness of Higgs bosons .... See Entry 65093

Cabibbo mixing, natural flavour conservation and CP violation in a left right symmetric electroweak gauge model with horizontal symmetry. .... See Entry 65094

Electroweak effects in $e^+e^- \rightarrow \mu^+\mu^-$ at 29 GeV .... See Entry 65142

Spin asymmetries in W and Z production at pp and p̄p colliders .... See Entry 65184

12.35 COMPOSITE MODELS OF PARTICLES

5th High Energy Spin Symposium .... See Entry 64572

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received) .... See Entry 64598

An SU(4)⊗SU(2)⊗U(1) unified model .... See Entry 65086

12.35C General properties of quantum chromodynamics (dynamics, confinement, etc.)

65108 Why QCD lattice theory is important to spin physicists. C.Rebbi (Brookhaven Nat. Lab., Upton, NY, USA).
AIP Conf. Proc. (USA), no.95, p.289-91 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Aspects of lattice gauge field theories which may be of relevance for spin physics are reviewed. (5 refs.)

65109 Spin physics and inclusive processes at short distances. N.S.Craigie (Internat. Centre for Theoretical Phys., Trieste, Italy).
AIP Conf. Proc. (USA), no.95, p.292-309 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
This talk is divided into an introduction: Why Spin Physics at Short Distances; a second chapter on factorization theorem in perturbative QCD and helicity asymmetries in inclusive processes; a third chapter on effect of higher order radiative corrections on helicity asymmetries; a fourth chapter on higher order power mechanisms at intermediate p_T; a fifth chapter on difficulties in understanding transverse spin in perturbative QCD and a final chapter on

helicity asymmetries at short distances as a means of probing supersymmetric QCD interactions. (23 refs.)

65110 Qualitative features of fixed angle elastic scattering in perturbative QCD. B.Pire (Stanford Linear Accelerator Center, Stanford, CA, USA), J.P.Ralston.
AIP Conf. Proc. (USA), no.95, p.347-51 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors point out recent qualitative features predicted by perturbative QCD that make fixed angle elastic scattering a useful testing ground. They emphasize two aspects: the asymptotic power behavior and the coherent effect of imaginary parts of Sudakov corrections. The second feature, called the chromo-Coulomb phase, can introduce oscillatory components into the cross-section ($d\sigma/dt$) and in the spin parameters (e.g. A_{nn}) at 90° and medium energy. (7 refs.)

65111 Spin effects in large angle two body reactions at high energy. P.Chiappetta, J.Soffer (Centre de Phys. Theorique, CNRS, Marseille, France).
AIP Conf. Proc. (USA), no.95, p.352-4 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Large angle two body processes at high energies are considered a most important class of reactions to test our understanding and on the behaviour of hadronic form factors which contain basic information about the composite nature of hadrons. For massless quarks, the QCD vector interaction preserves the quark helicity and this strong spin constraint leads to a selection rule for hadron helicities. (7 refs.)

65112 A self-consistent treatment of a non-linear effects in a model quark-antiquark-gluon system. D.E.L.Pottinger, R.C.Warner (Dept. of Natural Philosophy, Glasgow Univ., Glasgow, Scotland).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.336-58 (2 May 1983).
After presenting a formalism that is suitable for treating non-linear effects in a quantum setting, the authors analyse a model quark-antiquark-gluon system. This model is a truncated version of the full QCD Coulomb gauge hamiltonian in the heavy quark mass limit. Using a variational approximation, they show that the quark-antiquark-gluon singlet state becomes lower in energy than the pure quark-antiquark singlet for moderate values of the strong coupling constant, thus becoming the ground state of the system. (13 refs.)

65113 Numerical simulations of quantum chromodynamics. H.W.Hamber (Inst. for Advanced Study, Princeton, NJ, USA), E.Marinari, G.Parisi, C.Rebbi.
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.99-104 (21 April 1983).
A previously proposed method to perform Monte Carlo simulations with dynamical fermions is applied to lattice QCD. The main features of the computational technique are reviewed and results for some selected quantities, such as the average plaquette action and the quark condensate $\langle\bar{\psi}\psi\rangle$ are presented. Both the dependence on the quark mass and on the number of flavors are considered. An estimate of the scale parameter in the presence of fermions is given. (16 refs.)

65114 Failure of the Bloch-Nordsieck Mechanism in perturbative QCD. H.Banerjee (CERN, Geneva, Switzerland), A.Chatterjee, M.Sengupta.
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.105-8 (21 April 1983).
The authors find by direct diagram-wise calculation in Feynman gauge that at the two-loop level the Bloch-Nordsieck cross sections for the process (A)$q\bar{q}\rightarrow\gamma^*$ and its inverse (B)$\gamma^*\rightarrow q\bar{q}$ are both infrared divergent. The uncancelled infrared divergent piece in the BN cross section for either process has a leading behaviour which is double logarithm and not single logarithm as found for process (A) by several authors. (8 refs.)

65115 General infrared and ultraviolet properties of the gluon propagator in the axial gauge. G.B.West (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
Phys. Rev. D (USA), vol.27, no.8, p.1878-93 (15 April 1983).
Some general properties of the gluon propagator are studied in the axial gauge with emphasis on its infrared and ultraviolet behavior. In spacelike gauges the author derives a Lehmann representation and consequently a Kallen sum rule for Z_3. He investigates in some detail the apparent inconsistency between $Z_3>1$ (antiscreening and the origin of asymptotic freedom) and the positivity of the Hilbert space due to the absence of ghosts which suggests $Z_3<1$. He shows that in timelike gauges there is no Lehmann representation so that the propagator is no longer analytic in its virtual mass parameter. General positivity coupled with these results restricts certain IR singularities from being any worse than they are in QED, so consequently it is not possible to use the IR behavior of the propagator in this gauge (whether timelike or spacelike) as a signal for confinement if the Wilson loop is used as the criterion. He also shows that a judicious use of the renormalization group involving a variation of the axial-gauge parameter allows one to drive the theory into the IR in such a way that the effective coupling constant is the asymptotically free one. He uses this result to show that the presence of nonperturbative contributions of the generic form e^{-c/g^2} associated with instantons leads to a power-law correction to the IR behavior of the propagator. (28 refs.)

65116 An alternative implementation of the 'principle of minimal sensitivity'. J.C.Wrigley (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Phys. Rev. D (USA), vol.27, no.8, p.1965-7 (15 April 1983).
The author presents a simplified method of applying Stevenson's (1981) 'principle of minimal sensitivity' to perturbative calculations to all orders of quantum chromodynamics. In the next-to-leading-order case a direct comparison with the 'fastest apparent convergence' criterion is possible. (12 refs.)

65117 Comment on 'An alternative implementation of the "principle of minimal sensitivity"'. P.M.Stevenson (CERN, Geneva, Switzerland).
Phys. Rev. D (USA), vol.27, no.8, p.1968-9 (15 April 1983).
The author explains that the difficulties encountered by Wrigley (1983) in the preceding paper arise only because he is attempting to find the stationary value of an undefined function. (6 refs.)

65118 Precocious scaling and nonperturbative effects in QCD. W.Kummer (Inst. fur Theoretische Phys., Tech. Univ. Wien, Wien, Austria).
Z. Phys. C (Germany), vol.17, no.4, p.329-33 (1983).
The onset of nonperturbative effects in QCD is studied in two ways: (1) by means of the nonvanishing vacuum expectation value of $\langle g^2F^2\rangle$ introduced by Shifman, Vainshtein and Zakharov (1978); (2) using a finite energy sum rules (FESR) for the renormalization group function β. The author's considerations are based upon the recently proposed 'physical' β_{MMOM}, which is gauge invariant and shows explicit mass-decoupling. (14 refs.)

65119 Hadronic local fields in QCD. M.Azam, P.P.Divakaran (Tata Inst. of Fundamental Res., Bombay, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.5
A systematic procedure for the construction of local fields of definite spin for hadrons as composites of quarks and gluons is outlined and illustrated.

65120 On some aspects of asymptotic freedom. P.K.Patnaik (Dept. of Phys., Sambalpur Univ., Sambalpur, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.7
Analysing the Vacuum polarisation diagrams the author rederives the expression $\alpha_x(q^2)=1/(a+b\ln(Q^2/\wedge^2))$. Both a and b are found to be Q^2 dependent. The new expression, when applied to the results of specific processes is almost constant $\wedge$ for different Q^2 values. The applicability of this formula at present Q^2 values does not rule out the possibility of having more than sixteen quark flavours.

Improved semiclassical approximation ....See Entry 64752

Planar rotor: The θ-vacuum structure, and some approximate methods in quantum mechanics ....See Entry 64753

Renormalization scheme dependency and decoupling in the mass independent renormalization scheme ....See Entry 65006

On the single point field theories ....See Entry 65013

Quasi-Abelian versus large-N_c linear confinement ....See Entry 65055

Plasmon in the Coulomb gauge ....See Entry 65061

Weak CP violation in a model with invisible axion ....See Entry 65062

Moments of definite signature in lepton-hadron scattering and their right signature points ....See Entry 65153

Remarks on the $\phi\phi$ enhancement observed in $\pi^-p\rightarrow\phi\phi n$ .... See Entry 65179

Single spin asymmetry for Drell-Yan dileptons and the chromo-Coulomb phase: a new test of QCD ....See Entry 65196

Spin asymmetries in large P_T production of lepton pairs in the collision of polarized hadrons ....See Entry 65197

Parastatistics and the equation of state for the early Universe ....See Entry 69757

12.35E Applications of quantum chromodynamics to particle properties and reactions

65121 Meson widths and form factors at intermediate momentum transfer in non-perturbative QCD. B.L.Ioffe, A.V.Smilga (ITEP, Moscow, USSR).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.373-407 (2 May 1983).
A general method is proposed for the QCD based calculations of form factors at intermediate Q^2 and of the partial widths of the low-lying mesonic resonances. The basic idea is to use the QCD sum rules for the vertex functions and to saturate their Borel transform by the lowest mesonic states. With this method the pion electromagnetic form factor along with electromagnetic form factors of ρ and A_1 mesons and transition form factors $\gamma\pi\rightarrow A_1$ at $0.5\lesssim Q^2\lesssim 3$ GeV^2 are calculated. The widths $\rho\rightarrow 2\pi$ and $A_1\rightarrow\rho\pi$ are also determined. The results are in a good agreement with experiment. (31 refs.)

65122 Electrically neutral quarks: production of fractionally charged hadrons. R.V.Wagoner (Dept. of Phys., Stanford Univ., Stanford, CA, USA), I.Schmitt, P.M.Zerwas.
Phys. Rev. D (USA), vol.27, no.8, p.1696-704 (15 April 1983).
The authors explore some observational consequences of the existence of electroweak neutral, colour-triplet fermions, which combine with ordinary quarks to form fractionally charged hadrons (FCH) within QCD. Within the standard big-bang model, it is found that at least $\sim 4\times 10^{-20}$ FCH per photon survive from the early Universe. Calculations of their production in hadron-hadron and e^+-e^- colliders set a lower limit of ~ 10 GeV to their mass. The cosmic-ray-produced abundance of FCH at the surface of the Earth and Moon is also calculated. Within a more general framework, they show that a (nonzero) cosmic abundance of fractionally charged particles per nucleon smaller than $\sim 7\times 10^{-12}$ (outside stars) would be incompatible with the validity of standard (confining) QCD and the standard big-bang model. (34 refs.)

65123 The QCD behaviour for the valence quark distribution function of pions in the leading logarithm approximation and relevant differential cross-section. Zhang Mei-man, Shen Qi-xing, Wu Chi-min, Lu Jing-xian, Zhao Pei-ying (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.5-12 (Jan. 1983). In Chinese.
Using an analytic expression for valence quark distribution function of hadron in the leading logarithm approximation, the authors discuss the QCD behaviour for the valence quark distribution function of pions. The existing data are explained excellently. They also predict the differential cross section M^3 $(d\sigma)/(dM)$ for massive lepton pair production with the Drell-Yan mechanism and compare it with data. (25 refs.)

65124 Quantum chromodynamics predictions in renormalization scheme-independent perturbation theory. A.Dhar, V.Gupta (Tata Inst. of Fundamental Res., Bombay, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.4
It has been shown recently that any physical quantity R is determined implicitly as a function of only renormalization scheme invariants, ρ_0, ρ_1, ρ_2,....., to all orders for a massless field theory with a single coupling constant. Quantum chromodynamics predictions to two-loop order, within this scheme independent approach, are discussed for various quarkonia decays, e^+e^- annilation into hadrons and deep-inelastic scattering processes.

65125 Electromagnetic quark mass difference and dynamical symmetry breaking. H.S.Mani, J.P.Singh (Dept. of Phys., Indian Inst. of Technol., Kanpur, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.6
By considering the effect of QCD feedback on electromagnetic self-energy, the authors analyse up and down quark mass difference taken as the difference of electromagnetic self-energies, in a dynamically broken chiral-invariant QCD. They find that this does not remove the wrong sign of $(m_u$-$m_d)$ for any reasonable value of momenta.

65126 Masses and decay widths of some exotic particles and their implications. G.Bhamathi (Dept. of Theoretial Phys., Univ. of Madras, Madras, India), K.Prama.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.8
Studies on Glueballs and multiquark states have been recently intensified with the identification of the i(1440) and $\theta(1640)$ as possible candidates for glueballs. It has also been recognised that in this context hybrid or hermaphrodite states, involving quarks antiquarks and gluons, may be indistinguishable from genuine glueball and other states. Masses and decay widths of some exotic particles will be reported and their implications on the possible distinction between various types of exotic particles will be discussed.

65127 Heavy quarkonium systems in cut-off potential model. L.Chatterjee (High Energy Phys. Div., Jadavpur Univ., Calcutta, India), S.Bhattacharyya.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.9
A cut-off type approximation for the funnel potential for Quarkonium systems is used to calculate c and b quark masses by solution of the Schrodinger equation. Perturbations of the oscillator levels due to inclusion of the (I/r) term are estimated.

65128 Couplings of heavy flavour particles from QCD sum rules. C.P.Singh, S.N.Ram (Dept. of Phys., Banaras Hindu Univ., Varanasi, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.10
The authors calculate hadronic coupling constants of heavy flavoured particles in QCD by extrapolating from the asymptotic freedom regime using QCD sum rules. They discuss the relevance in the dynamics of SU(4) or SU(5) flavour symmetry breaking.

65129 Which is lighter—d or u quark?. S.Chakrabarty (Dept. of Phys., Visva-Bharati Univ., Santiniketan, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.12
The occurance of quarks in doublets in quantum flavour dynamics leads to the guess that probably the d quark is lighter than the u. The author applies potential models to study the bound states of a quark and an antiquark and find that only those potentials for which the mass of a bound state increases with increase in the mass of a constituent, allow both coloumb and confining potentials, and in this case the d quark must be heavier than the u quark. On the other hand, there are power law potentials which suggest that the d quark may be lighter than the u.

65130 Nuclei as metabags. K.Babu Joseph, V.G.Sreevalsa (Dept. of Phys., Univ. of Cochin, Cochin, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.14
An attempt is made to extend the MIT bag model of hadrons to nuclei. The authors consider the nucleus to be a metabag consisting of 3q clusters called minibags which can come in the singlet or octet representation of $SU(3)_c$. A universal mixing between the color singlet and color octet configurations is postulated in constructing a zero order bag model wave function for the nucleus. The introduction of a one-gluon-exchange phenomenological interaction between different 3q clusters leads to an interacting system of nucleons as well as a non-interacting one, the former being identified as the true nuclear configuration. Using the MIT bag hamiltonian for the unperturbed part, the masses of several nuclear species are calculated.

65131 Breakdown of Bloch-Nordsieck conjecture in the fourth order of perturbation for $q\bar{q}\rightarrow\gamma^*$. H.Banerjee, A.Chatterjee, M.Sengupta (Saha Inst. of Nuclear Phys., Calcutta, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.24
The Block-Nordsieck (B-N) theorem states that, in a given order of perturbation of a semi-inclusive cross-section in QED infrared divergence (IRD) due to virtual photons cancel with those due to experimentally unobserved soft photon emission in the final state. Recently some authors have made the important discovery that the B-N mechanism of IRD cancellation between real and virtual gluons breaks down in perturbative QCD with massive quarks. The authors have examined the question of breakdown of the B-N mechanism in the process $q\bar{q}\rightarrow\gamma^*+$soft gluons.

Cabibbo mixing, natural flavour conservation and CP violation in a left right symmetric electroweak gauge model with horizontal symmetry. .... See Entry 65094

Monte Carlo simulation of radiative corrections to the processes $e^+e^-\rightarrow\mu^+\mu^-$ and $e^+e^-\rightarrow\bar{q}q$ in the Z_0 region .... See Entry 65139

Neutrino and antineutrino charged-current inclusive scattering in iron in the energy range $20<E_\nu<300$ GeV .... See Entry 65144

The estimates of the vector and pseudoscalar decay constants .... See Entry 65145

Effect of triple gluon coupling in semi-inclusive polarized scattering processes .... See Entry 65156

Angular distribution of two observed hadrons in electron-position annihilation .... See Entry 65161

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

Prospects of technicolor-signatures in hadronic collisions .... See Entry 65192

Formation and signature of quark matter in relativistic ion collisions: evidence from cosmic rays .... See Entry 65227

12.35H Phenomenological composite models of particle structure and reactions (partons, bags, etc.)

65132 Spin-dependent hyperfine interactions in the positive-parity nonstrange excited baryons. B.F.Tynemouth (Phys. Dept., Univ. of Edinburgh, Edinburgh, Scotland).
J. Phys. G (GB), vol.9, no.5, p.a497-509 (May 1983).
The author uses the nonrelativistic harmonic-oscillator quark model as a basis in which to study the effects of including, in a consistent manner, all the spin-dependent hyperfine interactions which arise from the nonrelativistic reduction of one-gluon exchange and confinement, in the calculation of the masses of the nonstrange baryons commonly assigned to the second excited level. The results are in good qualitative agreement with present experimental data. (18 refs.)

65133 Deformed solutions of the MIT quark bag model. D.Vasak, R.Shanker, B.Muller, W.Greiner (Inst. fur Theoretische Phys., Johann Wolfgang Goethe-Univ., Frankfurt am Main, Germany).
J. Phys. G (GB), vol.9, no.5, p.511-20 (May 1983).
The authors have solved the quark confinement boundary-value problem of the MIT bag model numerically for axially deformed bag shapes. As first results they present a Nilsson-type level diagram for quarks confined in a deformed cavity. Minimising the baryon energy with respect to the shape parameters, they also calculate the masses of baryonic states. Here the results show very clearly that excited baryon resonances are intrinsically deformed. (20 refs.)

65134 Spectroscopy of charmed baryons. T.Morii (Dept. of Phys., Univ. of Wuppertal, Wuppertal, Germany), M.Kaburagi, M.Kawaguchi, T.Kitazoe, M.Tomita, J.Morishita, M.Oka.
Z. Phys. C (Germany), vol.17, no.3, p.219-27 (1983).
An atomlike baryon composed of one heavy quark and two light quarks is studied in a similar way to the Breit theory of a helium atom. Spectroscopy of charmed baryons is given for the vector Coulomb plus scalar linear confining potential. (13 refs.)

65135 The pressure ensemble as a tool for describing the hadron—quark phase transition. R.Hagedorn (CERN, Geneva, Switzerland).
Z. Phys. C (Germany), vol.17, no.3, p.265-81 (1983).
The author applies the technique of Gaussian regularization to the grand canonical pressure partition function to show that under physically meaningful boundary conditions (nonexistence of external confining vessels, i.e. no fixed volumes) the energy density and similar intensive quantities have, in a statistical bootstrap model of extended hadrons (Van der Waals type volume corrections), indeed the singularity claimed. Earlier results obtained with an entirely different technique (which had been criticized) are recovered and shown to be correct. The technique used here is useful in all cases where the volume is not imposed from the outside, but results from the internal dynamics of the system as is generally the case in high energy physics and astrophysics. (14 refs.)

65136 Masses and some electromagnetic properties of charm and b-quark hadrons in a bag model with a variable bag pressure. P.K.Chatley (Dept. of Phys., Panjab Univ., Chandigarh, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.11
The author investigates how a new bag phenomenology with a variable bag pressure as its main ingredient is successful in reproducing various properties of heavy hadrons. The results for masses, magnetic moments, and M1 radiative decay widths indicate that these properties arise in a natural and consistent manner from the theory.

65137 Decay of glue balls to a pair of mesons. K.Biswal, S.P.Misra (Inst. of Phys., Bhubaneswar, India).
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.13
It is at present widely believed on the basis of the MIT bag model that we may have colour singlet hadrons as two gluon bound states. The authors discuss here specific decay modes of such two gluon bound states to pairs of mesons. They notice that there is a possible dynamical mechanism which will enhance the probability of decay to channels with less phase space rather than to channels with more phase space.

The accidental degeneracy problem in nonrelativistic quantum mechanics .... See Entry 64724

Virial theorems for relativistic spin-$^1/_2$ and spin-0 particles .... See Entry 65052

Quasi-Abelian versus large-N_c linear confinement .... See Entry 65055

Proton decay in terms of an effective baryon-lepton transition .... See Entry 65090

Elementary particles as mass eigenstates of quantum-relativistic particles .... See Entry 65138

Decay processes in the massive straton model of mesons .... See Entry 65147

On extracting weak quark couplings from bottom and top decays .... See Entry 65149

The axial form factor of the nucleon and the pion-nucleon vertex function .... See Entry 65152

Baryon production in e^+e^- .... See Entry 65159

Charm fragmentation function—a comparison of neutrino and e^+e^- data .... See Entry 65160

Dibaryon resonances .... See Entry 65162

Spin-spin asymmetries in large angle proton-proton elastic scattering .... See Entry 65172

A quark reaarrangement model with spatial overlapping function for low energy NN annihilation .... See Entry 65174

Direct photon production beyond leading log aproximation—$q+q\rightarrow\gamma+q+q$ contribution .... See Entry 65176

Quark recombination in deuteron fragmentation .... See Entry 65191

Finding the t- quark in W boson decay debris .... See Entry 65194

12.35K Other composite models

(inc. composite quarks and leptons)

Electromagnetic binding with only zero orbital angular momentum, low-energy states .... See Entry 64742

12.40 MODELS OF STRONG INTERACTIONS

Rites of spin .... See Entry 65005

Spin-spin asymmetries in large angle proton-proton elastic scattering .... See Entry 65172

12.40E Statistical models

The pressure ensemble as a tool for describing the hadron—quark phase transition .... See Entry 65135

The estimates of the vector and pseudoscalar decay constants .... See Entry 65145

Pion and kaon form factors in the statistical model .... See Entry 65151

12.40F Bootstrap models

The pressure ensemble as a tool for describing the hadron−quark phase transition .... See Entry 65135

12.40H Duality and dual models

Surface terms and dual formulations of gauge theories .... See Entry 65050

Quasi-Abelian versus large-N_c linear confinement .... See Entry 65055

12.40K Hadron classification schemes

Fire string model for the large transverse momentum production of lepton pairs in proton-proton collision .... See Entry 65189

12.40M Complex angular momentum plane; Regge poles and cuts (Reggeons)

(see also 11.60 for general theory)

Elementary particles as mass eigenstates of quantum-relativistic particles .... See Entry 65138

Remarks on the $\phi\phi$ enhancement observed in $\pi^- p \to \phi\phi n$ .... See Entry 65179

12.70 HADRON MASS FORMULAS

65138 Elementary particles as mass eigenstates of quantum-relativistic particles. M.Banai, B.Lukacs (Central Res. Inst. for Phys., Budapest, Hungary).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.16, p.533-8 (16 April 1983).
The authors propose an approach to classically (c) relativistic quantum (q) theory. It seems quite natural to suppose that there exists some connection between the mass m and the wave function $\phi(x)$. Thus it is assumed that eigenvalue equations $\hat{m}\phi = m\phi$ are valid for q objects (particles) of state space $L^2(R^3)$. In this simple approximation they obtain that the corresponding cq particles (mesons) lie along linear Regge trajectories. This approach reproduces in a simple way the main aspects and results of the relativistic harmonic-oscillator quark models. They present an expression for the discrete spectrum of the q particle $(\text{mass})^2$ states. (19 refs.)

Hadron spectrum, spontaneous breaking of Z(3) and fake loops in lattice SU(3) .... See Entry 65043

Generalized Hooke groups and the mass-spectrum problem .... See Entry 65074

13.00 SPECIFIC REACTIONS AND PHENOMENOLOGY

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received) .... See Entry 64598

13.10 WEAK AND ELECTROMAGNETIC INTERACTIONS OF LEPTONS

65139 Monte Carlo simulation of radiative corrections to the processes $e^+e^- \to \mu^+\mu^-$ and $e^+e^- \to \bar{q}q$ in the Z_0 region. F.A.Berends, R.Kleiss (Inst. Lorentz, Leiden, Netherlands), S.Jadach.
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.185-200 (April 1983).
Radiative corrections to a process are experiment dependent. A Monte Carlo simulation of both $\mu^+\mu^-$ and $\mu^+\mu^-\gamma$ events is ideally suited for imposing any experimental cuts. (2 refs.)

65140 Radiative corrections to Higgs production by $e^+e^- \to ZH$ in the Weinberg-Salam model. J.Fleischer, F.Jegerlehner (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.469-92 (2 May 1983).
Presents a complete analysis of the one-loop radiative corrections to the associated production of a Higgs boson (H) and a neutral vector boson (Z) in e^+e^- annihilation up to energies and Higgs-boson masses of 1 TeV. In the region of interest for future experiments $E \lesssim 200$ GeV ($m_H \lesssim 100$ GeV) the authors find corrections of $+25\%$ which are essentially cancelled by soft-photon effects. The latter amount to -31% for an electron counter resolution of 0.1. (26 refs.)

65141 Production of a pseudoscalar meson with a lepton-antilepton pair in e^+e^- collisions. T.Miyazaki, Y.Ishizaki, K.Kuniyoshi (Dept. of Phys., Sci. Univ. of Tokyo, Tokyo, Japan).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.217-36 (21 March 1983).
The production of a pseudoscalar meson with an e^+e^- or $\mu^+\mu^-$ pair is studied in a model-independent way. At a certain configuration of the produced e^+e^-, it especially becomes large and the process is not only important to search for a new particle which can decay into two photons, but also in that it gives a considerable QED background to other experiments of e^+e^- pair production. (9 refs.)

65142 Electroweak effects in $e^+e^- \to \mu^+\mu^-$ at 29 GeV. E.Fernandez, W.T.Ford, A.L.Read,Jr., J.G.Smith (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA), A.Marini, I.Peruzzi, M.Piccolo, F.Ronga, H.T.Blume, R.Weinstein, L.Baksay, H.R.Band, W.L.Faissler, M.W.Gettner, G.P.Goderre, B.Gottschalk, R.B.Hurst, O.A.Meyer, J.H.Moromisato, W.D.Shambroom, E.von Goeler, J.V.Allaby, W.W.Ash, G.B.Chadwick, S.H.Clearwater, R.W.Coombes, Y.Goldschmidt-Clermont, H.S.Kaye, K.H.Lau, R.E.Leedy, H.L.Lynch, R.L.Messner, S.J.Michalowski, K.Rich, D.M.Ritson, L.J.Rosenberg, D.E.Wiser, R.W.Zdarko, D.E.Groom, Hoyun Lee, E.C.Loh, M.C.Delfino, B.K.Heltsley, J.R.Johnson, T.L.Lavine, T.Maruyama, R.Prepost.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1238-41 (25 April 1983).
A measurement of the cross section for production of collinear muon pairs based upon a sample of about 3000 events observed in the MAC detector at the storage ring PEP is presented. From the angular asymmetry $A_{\mu\mu} = 0.076 \pm 0.018$ the axial-vector weak neutral coupling is found to be given by $g_A{}^e g_A{}^\mu = 0.31 \pm 0.08$. (9 refs.)

Effect of triple gluon coupling in semi-inclusive polarized scattering processes .... See Entry 65156

13.15 NEUTRINO INTERACTIONS

(inc. interactions involving cosmic rays)

65143 Measurement of the polarization of positive muons produced in high-energy antineutrino interactions. M.Jonker, F.Udo (Nikhef, Amsterdam, Netherlands), J.V.Allaby, U.Amaldi, G.Barbiellini, A.Capone, W.Flegel, M.Metcalf, J.Meyer, F.L.Navarria, J.Panman, A.M.Wetherell, K.Winter, F.W.Busser, H.Daumann, P.D.Gall, E.Metx, F.Niebergall, K.H.Ranitzsch, P.Stahelin, E.Grigoriev, V.Kaftanov, V.Khovansky, A.Rosanov, A.Baroncelli, B.Borgia, C.Bosio, F.Ferroni, E.Longo, P.Monacelli, F.de Notaristefani, P.Pistilli, C.Santoni, V.Valente.
Z. Phys. C (Germany), vol.17, no.3, p.211-17 (1983).
The question whether scalar-type interations contribute to weak interactions at large momentum transfer has been investigatied by a measurement of the longitudinal polarization of positive muons produced in charged-current interactions of high-energy antineutrinos with iron. At an average momentum transfer $\langle Q^2 \rangle = 4$ GeV^2 the muon spin is found to be oriented forward with respect to the muon momentum vector, with an average polarization of 1.10 ± 0.24, consistent with positive helicity. A limit on scalar contributions of $\sigma_{s,p}/\sigma_{tot} < 7\%$ at the 95% confidence level can be deduced. A search for violation of time reversal invariance which could manifest itself by a polarization component perpendicular to the muon production plane gave a limit of $\sigma_{tv}/\sigma_{tot} < 16\%$ (95% CL). It is concluded that the weak leptonic charged current retains its dominant vector and axial vector structure at large momentum transfers. (23 refs.)

65144 Neutrino and antineutrino charged-current inclusive scattering in iron in the energy range $20 < E_\nu < 300$ GeV. H.Abramowicz, J.G.H.de Groot, J.Knobloch, J.May, P.Palazzi, A.Para, F.Ranjard, A.Savoy-Navarro, D.Schlatter, J.Steinberger, H.Taureg, W.von Ruden, H.Wahl, J.Wotschack (CERN, Geneva, Switzerland), P.Buchholz, F.Eisele, H.P.Klasen, K.Kleinknecht, H.Lierl, D.Pollmann, B.Pszola, B.Renk, H.J.Willutzki, F.Dydak, T.Flottmann, C.Geweniger, J.Krolikowski, K.Tittel, P.Bloch, B.Devaux, C.Guyot, J.P.Merlo, B.Peyaud, J.Rander, J.Rothberg, R.Turlay, J.T.He, T.Z.Ruan, W.M.Wu.
Z. Phys. C (Germany), vol.17, no.4, p.283-307 (1983).
Inclusive charged-current interactions of high-energy neutrinos and antineutrinos have been studied with high statistics in a counter experiment at the CERN Super Proton Synchrotron. The energy dependence of the total cross-sections, the longitudinal structure function, and the nucleon structure functions F_2, xF_3, and $\bar{q}^{\bar{\nu}}$ are determined from these data. The analysis of the Q^2-dependence of the structure functions is used to test quantum chromodynamics, to determine the scale parameter Λ and the gluon distribution in the nucleon. (30 refs.)

Charm fragmentation function−a comparison of neutrino and e^+e^- data .... See Entry 65160

13.20 LEPTONIC AND SEMILEPTONIC DECAYS OF MESONS

65145 The estimates of the vector and pseudoscalar decay constants. S.N.Banerjee, A.K.Sarker (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Phys. Scr. (Sweden), vol.27, no.3, p.163-5 (March 1983).
Using an improved version of the Van Royen-Weisskopf formula, the leptonic decay widths, decay constants of ψ, Υ and pseudoscalar particles have been computed in the statistical model. The calculated results are found to compare favourably with the experimental findings and other theoretical estimates. (9 refs.)

Decay processes in the massive straton model of mesons .... See Entry 65147

13.25 HADRONIC DECAYS OF MESONS

65146 Einstein locality and the $K^0\bar{K}^0$ system. F.Selleri (Istituto di Fisica, Univ. di Bari, Bari, Italy).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.16, p.521-6 (16 April 1983).
By applying Einstein locality to the $J^{PC} = 1^{--}$ state of two neutral kaons the authors obtain for correlated observations of two K^0 interactions a rate 12% lower than predicted by quantum mechanics. (4 refs.)

65147 Decay processes in the massive straton model of mesons. Ding Yi-bing (Graduate School, Univ. of Sci. & Technol. of China, China), Chao Kuang-ta.
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.28-34 (Jan. 1983). In Chinese.
Using the B-S wave functions of mesons in the massive straton model, the authors discuss their weak decay, electromagnetic decay, and particularly hadronic decay processes. Not only are $f_\pi \approx f_K$ and the $1^- \to 1^+1^-$ rate successfully explained, but also the predicted widths for various hadronic decays are in good agreement with experimental data. (14 refs.)

65148 Experimental upper limits for hadronic and axion decays of the Υ(1S). B.Niczyporuk, Z.Jakubowski, T.Zeludziewicz (Inst. of Nuclear Phys., Cracow, Poland), G.Folger, B.Lurz, H.Vogel, U.Volland, H.Wegener, J.K.Bienlein, R.Graumann, H.-J.Trost, M.Schmitz, F.H.Heimlich, R.Nerst, A.Schwarz, U.Strohbusch, P.Zschorsch, K.W.Chen, A.C.Konig, D.J.Schotanus, M.Coles, A.Engler, R.W.Kraemer, D.Marlow, F.Messing, C.Rippich, S.Youssef, A.Fridman, G.Alexander, A.Av-Shalom, G.Bella, J.Grunhaus, W.Langguth, M.Scheer.
Z. Phys. C (Germany), vol.17, no.3, p.197-202 (1983).
A search for the decays $\Upsilon \to \rho\pi$, $\Upsilon \to J/\psi X$ and $\Upsilon \to \gamma a$(where X is undetermined and a is an axion) has been completed using the LENA detector at the DORIS storage ring. No evidence for any of these processes was found. For these decay modes the authors set branching fraction upper limits (90% CL) of 2.1×10^{-3}, 2.0×10^{-2} and 9.1×10^{-4}, respectively. (29 refs.)

Meson widths and form factors at intermediate momentum transfer in non-perturbative QCD .... See Entry 65121

Decay of glue balls to a pair of mesons .... See Entry 65137

13.30 DECAYS OF BARYONS

65149 On extracting weak quark couplings from bottom and top decays. I.I.Bigi, H.G.Evertz (Inst. fur Theoretische Phys., RWTH Aachen, Aachen, Germany).
Nucl. Phys. B, Part. Phys. (Netherlands), vol.B216, no.2, p.359-72 (2 May 1983).
The authors list and discuss the various types of systematic uncertainties one faces when extracting quark mixing angles from the decays of bottom and top hadrons. Evaluating various suggested methods they conclude that a study of

the lepton energy spectrum in B and T decays provides a reasonable way of obtaining the ratio of mixing angles; yet analysis of just the endpoint region will not lead to a reliable determination. Such results should be backed up by other studies based on very energetic kaons and on the mode $B^- \rightarrow \tau^- \bar{\nu}_\tau$. A dedicated effort should be made to search for flavour changing neutral currents in channels like B, $T \rightarrow \tau^+ \tau^- X$. (11 refs.)

65150 Neutrino backgrounds in the Kolar Gold Field nucleon decay experiment. M.R.Krishnaswamy, M.G.K.Menon, N.K.Mondal, V.S.Narasimham, B.V.Sreekantan (Tata Inst. of Fundamental Res., Bombay, India), Y.Hayashi, N.Ito, S.Kawakami, S.Miyake.
Pramana (India), vol.19, no.6, p.525-54 (Dec. 1982). [received: April 1983]
The neutrino events recorded in the Kolar Gold Field nucleon decay detector are analysed. It is shown that there is good agreement between the observations and the estimates based on the intensities of atmospheric neutrinos and interaction cross-sections of neutrinos available from accelerator experiments. In the context of the search for proton decay, the authors show that the low energy (<2 GeV) neutrino events, which would provide the main background, are suppressed at the KGF site since it is situated near geomagnetic equator, where the geomagnetic cut-off rigidities are high. A comparison of the predicted characteristics of ν-induced events with the KGF observations shows that, within the statistical accuracy of the present data, the signal due to nucleon decay stands out distinctly within the ν-induced background. (34 refs.)

13.40 ELECTROMAGNETIC PROCESSES AND PROPERTIES

13.40F Electromagnetic form factors; electric and magnetic moments

65151 Pion and kaon form factors in the statistical model. S.N.Banerjee, R.K.Das (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Can. J. Phys. (Canada), vol.61, no.4, p.532-4 (April 1983).
The pion and kaon form factors have been studied in the context of the statistical model and the size of the meson is found to have a sensitive dependence upon the form of the form factor in the model. (8 refs.)

65152 The axial form factor of the nucleon and the pion-nucleon vertex function. P.A.M.Guichon, G.A.Miller, A.W.Thomas (CERN, Geneva, Switzerland).
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.109-12 (21 April 1983).
The axial form factor of the nucleon in the Cloudy Bag Model is harder than the $NN\pi$ vertex function, and consistent with data for a bag radius about 1 fm. The authors examine how these results are altered by excluding the pion field from a smaller, interior volume. (19 refs.)

65153 Moments of definite signature in lepton-hadron scattering and their right signature points. S.Koretune (Dept. of Phys., Fukui Medical School, Fukui, Japan).
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.113-16 (21 April 1983).
It is shown that the distinction between the structure function defined by the current commutator and the one defined by the current anticommutator is important when one derives moment sum rules in lepton-hadron scattering. By taking this fact into consideration, the author defines moments of definite signature and continue them analytically in the complex n plane where signature is the concept which we met in analytical continuation in angular momentum. Then the author shows that the missing integers in the classical derivation of the moment sum rules in QCD become the right signature points of the ones given by the structure function defined by the current anticommutator. This fact proves conjectures as to analytical continuation of the anomalous dimension proposed by Ross and Sachrajda, (1978). (8 refs.)

5th High Energy Spin Symposium .... See Entry 64572

Charmed baryon magnetic moments in broken SU(8) model .... See Entry 65077

Spin effects in large angle two body reactions at high energy .... See Entry 65111

Meson widths and form factors at intermediate momentum transfer in non-perturbative QCD .... See Entry 65121

Neutrino and antineutrino charged-current inclusive scattering in iron in the energy range $20<E_\nu<300$ GeV .... See Entry 65144

Angular distribution of two observed hadrons in electron-position annihilation .... See Entry 65161

Single spin asymmetry for Drell-Yan dileptons and the chromo-Coulomb phase: a new test of QCD .... See Entry 65196

New application of the superthermal Ultra-Cold Neutron source. I. The search for the neutron electric dipole moment .... See Entry 65805

13.40H Electromagnetic decays

Proton decay in terms of an effective baryon-lepton transition .... See Entry 65090

Masses and some electromagnetic properties of charm and b-quark hadrons in a bag model with a variable bag pressure .... See Entry 65136

Decay processes in the massive straton model of mesons .... See Entry 65147

Experimental upper limits for hadronic and axion decays of the Υ(1S) .... See Entry 65148

13.40K Electromagnetic corrections to strong and weak interaction processes

Spin physics and inclusive processes at short distances .... See Entry 65109

Monte Carlo simulation of radiative corrections to the processes $e^+e^- \rightarrow \mu^+\mu^-$ and $e^+e^- \rightarrow \bar{q}q$ in the Z_0 region .... See Entry 65139

Radiative corrections to Higgs production by $e^+e^- \rightarrow ZH$ in the Weinberg-Salam model .... See Entry 65140

13.60 PHOTON AND CHARGED-LEPTON INTERACTIONS WITH HADRONS

(for neutrino interactions, see 13.15)

The polarized beam asymmetry for $\gamma d \rightarrow Pn$ in the energy range 0.4-0.8 GeV .... See Entry 65252

13.60F Elastic and Compton scattering

65154 Compton scattering: test of the double differential cross section in the relativistic impulse approximation. A.Reineking, R.Wenskus, A.Baumann, D.Schaupp, P.Rullhusen, F.Smend, M.Schumacher (Phys. Inst., Univ. Gottingen, Gottingen, Germany).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.29-31 (11 April 1983).
Cross sections $d^2\sigma/d\Omega dE_{\gamma 2}$ for bound Compton scattering are calculated in the relativistic impulse approximation using DHFS wave functions. Agreement is observed with experiment for $E_{\gamma 1}=279$ and 662 keV at the peak of the profiles. Discrepancies found at the high-energy side are only partly explained by second-order S-matrix calculations. (16 refs.)

65155 Differential cross sections of proton Compton scattering at photon laboratory energies between 1.2 and 1.7 GeV. J.Duda, F.-W.Hofner, M.Jung, R.Kleissler, H.Kuck, P.Leu, K.-D.deMarne, B.Munk, W.Vogl, R.Wedemeyer (Phys. Inst., Univ. Bonn, Bonn, Germany).
Z. Phys. C (Germany), vol.17, no.4, p.319-23 (1983).
Differential cross sections of proton Compton scattering have been measured at the Bonn 2.5 GeV synchrotron. The experiment covers photon laboratory energies between 1.2 GeV and 1.7 GeV and the square of the four-momentum transfer ranges from $t=-0.17$ GeV^2 to -0.98 GeV^2 corresponding to c.m. scattering angles between 35° and 80°. The cross sections exhibit a forward peak followed by a continuous fall-off up to the largest measured $|t|$-values. Fits of the form $d\sigma/dt = A.\exp(Bt)$ to the data points with $|t| \leq 0.5$ GeV^2 yield forward cross sections A, which are consistent with the 0^0 cross sections calculated from the measured total photon-proton cross section. The average slope is $B=5.6\pm0.14$ GeV^2. (13 refs.)

Asymmetry parameters in the polarized e-p and e-d scattering within the framework of $SU(2)_L \times U(1) \times U(1)$ and SO(10) gauge models ..See Entry 65095

Moments of definite signature in lepton-hadron scattering and their right signature points .... See Entry 65153

13.60H Total and inclusive cross sections

(inc. deep-inelastic processes)

65156 Effect of triple gluon coupling in semi-inclusive polarized scattering processes. E.N.Argyres (Phys. Dept., State Univ. of New York, Coll. of Arts & Sci., Plattsburgh, NY, USA), C.S.Lam, Bing-an Li.
Z. Phys. C (Germany), vol.17, no.4, p.335-40 (1983).
Show that the gluon helicity inside a proton and a photon can be deduced from a knowledge of a special combination of cross sections of the semi-inclusive processes $e+p \rightarrow e+\pi+\pi+\ldots$ and $e^+ + e^- \rightarrow e^+ + e^- + \pi + \pi + \ldots$. Such a measurement could thus be used to check the QCD prediction that the gluon helicity increases linearly with $\ln Q^2$. (7 refs.)

Spin physics and inclusive processes at short distances .... See Entry 65109

Polarization and inclusive reactions: an introduction for the theory workshop [spin physics] .... See Entry 65195

13.60K Meson production

65157 On the ambiguity of estimates of the isotopic multipole amplitudes for the pion photoproduction on protons. V.F.Grushin, E.M.Leikin, A.Ya.Rotvain, A.A.Shikanyan.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.33-5 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.38-40 (1982).
Discusses a method for removing the continuous nonuniqueness of solutions of the isotopic multipole analysis of photoproduction on protons which does not require the use of the data on the phase of πN scattering, or to postulate the magnitude of any amplitude. (3 refs.)

13.65 HADRON PRODUCTION BY ELECTRON-POSITRON COLLISIONS

65158 Study of the ω meson in the VEPP-2M storage ring. A.M.Kurdadze, E.V.Pakhtusova, V.A.Sidorov, A.G.Chilingarov, Yu.V.Shatunov, B.A.Shvarts, S.I.Eidel'man (Inst. of Nuclear Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.274-6 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.221-3 (20 Sept. 1982). [received: April 1983]
The reaction $e^+e^- \rightarrow \pi^+\pi^-\pi^0$ has been studied at c.m. energies from 760 to 800 MeV in the VEPP-2M storage ring. The following parameters were found for the ω resonance: $M_\omega=782.2\pm0.4$ MeV, $\Gamma_\omega=9.8\pm0.9$ MeV, $\sigma_{max}(\omega \rightarrow \pi^+\pi^-\pi^0)=1.39\pm0.10$ μb, and $\Gamma(\omega \rightarrow e^+e^-)=0.63\pm0.05$ keV. (10 refs.)

65159 Baryon production in e^+e^-. B.Klima (Dept. of Phys. & Astron., Tel Aviv Univ., Ramat Aviv, Israel).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.209-16 (21 March 1983).
Presents a simple classical model for baryon production in e^+e^- interactions. Its predictions can be checked precisely at the threshold for heavy-flavour production. The author expects a relative step of about 10% in $\Delta R(p+\bar{p})$ and in $\Delta R(\Lambda+\bar{\Lambda})$ near the $\Lambda_b\bar{\Lambda}_b$ threshold (at about 11 GeV). If the t-quark exists, the author predicts a larger step in $\Delta R(\Lambda+\bar{\Lambda})$ of about 50% when passing the $\Lambda_t^+\Lambda_t^-$ threshold. (12 refs.)

65160 Charm fragmentation function—a comparison of neutrino and e^+e^- data. K.Kleinknecht, B.Renk (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Z. Phys. C (Germany), vol.17, no.4, p.325-8 (1983).
Experimental data on the fragmentation of charmed quarks produced in neutrino and e^+e^- reactions are compared. The resulting hard fragmentation functions agree mutually. They are parametrized in two ways suggested by kinematical considerations. (17 refs.)

65161 Angular distribution of two observed hadrons in electron-position annihilation. D.E.Soper (Inst. of Theoretical Sci., Univ. of Oregon, Eugene, OR, USA).
Z. Phys. C (Germany), vol.17, no.4, p.367-9 (1983).
Discusses the angular structure of the cross section for $e^+ + e^- \rightarrow A+B+X$ and the closely related energy-energy correlation function. (6 refs.)

Spin physics and inclusive processes at short distances .... See Entry 65109

Electrically neutral quarks: production of fractionally charged hadrons .... See Entry 65122

Quantum chromodynamics predictions in renormalization scheme-independent perturbation theory .... See Entry 65124

Monte Carlo simulation of radiative corrections to the processes $e^+e^-\rightarrow\mu^+\mu^-$ and $e^+e^-\rightarrow q\bar{q}$ in the Z_0 region ....See Entry 65139

Evidence for the same two-particle correlations in rapidity space in (pp) collisions and (e^+e^-) annihilation ....See Entry 65188

Polarization and inclusive reactions: an introduction for the theory workshop [spin physics] ....See Entry 65195

13.75 HADRON-INDUCED LOW- AND INTERMEDIATE-ENERGY REACTIONS AND SCATTERING, ENERGY ≤ 10 GEV

(for higher energies, see 13.85)

Quark recombination in deuteron fragmentation ....See Entry 65191

Evidence for dibaryon resonances from the measurement of the tensor polarization t_{20} in π^+-d scattering ....See Entry 65292

Dibaryon search in the pi-d system ....See Entry 65293

13.75C Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)

(for N-N interactions in nuclei, see 21.30)

65162 Dibaryon resonances. A.B.Wicklund (Argonne Nat. Lab., Argonne, IL, USA).
AIP Conf. Proc. (USA), no.95, p.168-80 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Phase shift analyses of pp elastic scattering indicate resonance-like loops in several partial waves, which could be attributed to exotic 6-quark resonances or simply to inelastic threshold effects. Differences between theoretical predictions and experimental spin wave analyses are available in these channels. The nucleon-nucleon dibaryon candidates are coupled predominantly to the $NN\pi$ channels, and theoretical interpretation of these effects will require detailed understanding of the $NN\rightarrow\Delta N$ reaction. (68 refs.)

65163 Partial wave analysis of $pp-)\pi d$, πd elastic and pp elastic in the dibaryon region. N.Hiroshige, W.Watari (Res. Inst. for Atomic Energy, Osaka City Univ., Osaka, Japan), M.Yonezawa.
AIP Conf. Proc. (USA), no.95, p.181-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Results of a partial wave analysis of $p+p-)\pi+d$ reaction and $\pi+d$ elastic scattering are presented. The authors also give preliminary results on the pole structure in the $^1D_2$ state by the three channel K-matrix analysis. (14 refs.)

65164 Nucleon nucleon scattering experiments at SATURNE II. F.Lehar (CENS, Gif-sur-Yvette, France).
AIP Conf. Proc. (USA), no.95, p.187-92 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Using a proton polarized beam from SATURNE II and the Saclay frozen spin target the spin correlation parameter A_{oonn} and the total cross section difference $\Delta\sigma_T$ were measured. Including these preliminary data a phase shift analysis has been made. A possible structure in the pp spin singlet state near the mass 2.22 Gev is observed. (7 refs.)

65165 $p\uparrow p\uparrow$ scattering at SIN. E.Aprile-Giboni, G.Cantale, R.Hausammann, E.Heer, R.Hess, C.Lechanoine-LeLuc, W.R.Leo, S.Morenzoni, Y.Onel, D.Rapin (Univ. of Geneva, Geneva, Switzerland), S.Mango.
AIP Conf. Proc. (USA), no.95, p.193-8 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Using the PM1 polarized proton beam at SIN and a polarized target, the elastic $p\uparrow p\uparrow$ scattering as well as the inelastic channel $p\uparrow p\uparrow\rightarrow\pi^+d$ have been studied between 400 and 600 MeV. For the elastic reaction, a sufficient number of spin dependent parameters has been measured in order to do a direct reconstruction of the scattering matrix between 38° cm and 90° cm. (10 refs.)

65166 Spin parameter measurements in p-p elastic scattering at 6 and 11.75 GeV/c. R.G.Wagner (Argonne Nat. Lab., Argonne, IL, USA).
AIP Conf. Proc. (USA), no.95, p.210-16 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Results of recent analyses of two ZGS experiments at 6 and 11.75 GeV/c are presented. At 6 GeV/c the double scattering parameters K_{LS}, K_{NN}, D_{SS}, H_{LSN}, and H_{NSS} were measured as part of a program to determine the p-p elastic scattering amplitudes. Approximate values for the amplitudes are given. Preliminary data for C_{SS} and C_{LS} at 11.75 GeV/c are given and features of the data are compared with previous measurements of C_{NN}. The combined C_{SS} and C_{NN} data allow a determination of $\Delta\sigma_T{}^{el}$. (11 refs.)

65167 Proton-proton elastic amplitudes at several GeV. S.Wakaizumi (Hiroshima Univ., Hiroshima, Japan).
AIP Conf. Proc. (USA), no.95, p.217-22 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Proton-proton elastic scattering is analyzed at 6 and 12 GeV/c in the eikonal representation for scattering amplitudes by the use of the data on cross-sections and various spin-observables. The spin-dependent eikonals such as spin-spin and tensor couplings have turned out to have three components; long-range part, medium-range part and short-range part. The long-range force seems to be caused by the one-pion-exchange force from its range, sign and magnitude. The medium-range force is similar to the heavy-boson-exchange one. The short-range force has a range of 0.3-0.5 fm and a strength of 100-200 MeV, which may come from the quark hard scattering in QCD. The scattering amplitudes are obtained at both energies and their behavior is discussed. They have a strong and smooth energy-dependence. (10 refs.)

65168 Recent data in p-p elastic scattering and diproton resonances. A.Yokosawa (Argonne Nat. Lab., Argonne, IL, USA).
AIP Conf. Proc. (USA), no.95, p.223-5 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Presents data on spin-spin correlation parameters $C_{LL}=(L,L,;O,O)$ and $C_{SL}=(S,L;O,O)$ up to 2.47 GeV/c incident momentum in proton-proton elastic scattering. These data will be useful in clarifying ambiguities in phase-shift analyses, and in confirming diproton resonances. (11 refs.)

65169 Nucleon-nucleon experiments at LAMPF. M.W.McNaughton (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.95, p.243-5 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Nine major groups (in various collaborations) are involved with the continuing program of nucleon-nucleon measurements of LAMPF. The author summarizes the $pp\rightarrow pp$ data. In general, these data are in good agreement with Arndt's phase shift representation. No new neutron data have been obtained since that reported at the 1980 Santa Fe Conference, but a program of $np\rightarrow np$ spin correlation experiments is scheduled for 1983. The major effort in the proton beam lines will be in $\vec{p}\vec{p}\rightarrow pp$ at small angles (UCLA), and pp inelastic measurements. (6 refs.)

65170 Measurement of polarization parameters in pp elastic scattering and direct experimental reconstruction of the elastic scattering matrix at 445 MeV. E.Aprile, R.Hausamann, E.Heer, R.Hess, C.Lechanoine-LeLuc, W.Leo, S.Morenzoni, Y.Onel, D.Rapin (Univ. de Geneve, Geneve, Switzerland), S.Mango.
AIP Conf. Proc. (USA), no.95, p.246-8 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
These measurements are part of a series in progress at SIN with the objective of determining the nucleon-nucleon amplitudes in p-p elastic scattering between 400-600 MeV from a complete experiment. The authors have measured 15 observables at 8 angles between 62°-90° CM and 11 observables at 6 angles between 38°-58°CM. These observables include the polarization, the two-spin polarization transfer and three spin tensors and the two-spin correlation parameters. (4 refs.)

65171 $d\sigma/d\Omega$ and a_y for small angle pp elastic scattering at 1.46 GeV/c. G.Pauletta, G.Adams, S.M.Haji-Saeid, G.Igo, J.B.McClelland, A.Rahbar, A.T.M.Wang, C.A.Whitten,Jr., A.Wriekat (Univ. of California, Los Angeles, CA, USA), M.M.Gazzaly, N.Tanaka.
AIP Conf. Proc. (USA), no.95, p.249-51 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The measurement of pp elastic scattering observables in the Coulomb-nuclear interference region is an effective means of unravelling the various components of the pp scattering amplitude. Coulomb-nuclear interference terms make the phases of the nuclear components accessible. Small angle measurements may be sensitive to possible dibaryon resonances. It was pointed out by Hoshizaki (1978) that a calculation of the energy dependence of a $\rho=\mathrm{Re}[M_{1N}+M_{3N}]/\mathrm{Im}[M_{1N}+M_{3N}]$ (M_{iN}, i=1-5, are nuclear parts of the helicity amplitudes) near 800 MeV may show characteristics of resonance structure. By measuring the spin-averaged differential cross section $\sigma(\theta)$ in the Coulomb-nuclear interference region, ρ may be determined. The authors present results on both $\sigma(\theta)$ and analysing powers $A_y(\theta)$. The measurements were extended into $\theta_{lab}=0.5°$ and permitted both e M_{5N} and Im M_{5N} to be determined. (14 refs.)

65172 Spin-spin asymmetries in large angle proton-proton elastic scattering. M.Anselmino (Dept. of Phys., Westfield Coll., London, England).
AIP Conf. Proc. (USA), no.95, p.342-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
In the framework of the models describing p-p large angle elastic scattering in terms of quark-quark scattering, the author presents a simple possible explanation of the most striking spin effect. The author discusses the differences between this approach and others. (6 refs.)

65173 $^1S_0$-state nucleon-nucleon phase shifts due to solitary-wave exchange potentials. M.Sebhatu (Dept. of Chem. & Phys., Winthrop Coll., Rock Hill, SC, USA).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.16, p.513-18 (16 April 1983).
$^1S_0$-state proton-proton and neutron-proton phase shifts calculated using $\lambda\Phi^4$ and sine-Gordon solitary-wave exchange potentials (SWEPs) are compared with the phase shifts obtained by Arndt et al. and Bugg et al (1978) from recent world nucleon-nucleon scattering data. The SWEPs, utilizing only one more parameter than the basic Yukawa potential, reproduce the phenomenological phase shifts up to 500 MeV remarkably well. (17 refs.)

65174 A quark reaarrangement model with spatial overlapping function for low energy $N\bar{N}$ annihilation. M.Maruyama, T.Ueda (Dept. of Appl. Math., Osaka Univ., Osaka, Japan).
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.121-6 (21 April 1983).
The major part of the branching ratios for the $N\bar{N}$ annihilation at rest is explained by the quark rearrangement in the N and $\bar{N}$ into three SU(6) mesons. This is shown by using the spin, isospin, and spatial overlap function derived theoretically from quark dynamics. (12 refs.)

65175 Inclusive γ-produnction in $\bar{p}p$ interactions at 0.76 and 2.0 GeV/c. S.Banerjee, S.Chakrabarti, S.N.Ganguli, A.Gurtu, P.K.Malhotra, R.Raghavan, A.Subramanian, K.Sudhakar (Tata Inst. of Fundamental Res., Bombay, India).
Z. Phys. C (Germany), vol.17, no.3, p.203-10 (1983).
The inclusive production of photons in $\bar{p}p$ interactions has been studied at incident momenta of 0.76 and 2.0 GeV/c. The inclusive cross sections for γ-production and the average multiplicities of γ, $\langle n_y\rangle$, are presented as a function of the charged prong topology. Results on the two particle correlation parameters f^{00} and f^{-0} are presented. The inclusive distributions of the Feynman variable x and of the transverse momentum p_T of the photons are compared with the expectations from charged pion distributions on the basis of charge independence. A search has been made for direct γ-production in $\bar{p}p$ interactions at 0.76 GeV/c by looking for events which fit uniquely the hypothesis $\bar{p}p\rightarrow m\pi^+ + m\pi^- + \gamma$. (11 refs.)

65176 Direct photon production beyond leading log aproximation-$-q+q\rightarrow\gamma+q+q$ contribution. M.Nowk, M.Praszalowicz (Inst. of Phys., Jagellonian Univ., Cracow, Poland).
Z. Phys. C (Germany), vol.17, no.3, p.249-57 (1983).
The $q+q\rightarrow\gamma+q+q$ contribution (for incoming quarks of equal and different flavors) to the next-to-leading correction for the direct photon production in pp collisions is calculated, analyzed in terms of double moments and compared with the data. The dimensional regularization method is used and the final state Bremsstrahlung infinities are regularized by an angular cut-off. The correction is found to be 30-40% of the Born contribution providing a better description of the data. (20 refs.)

K, π, p scatterings from polarized deuteron at KEK ....See Entry 65180

Angular and energy dependence of the analyzing power A_{yo} of the reaction $p+p\rightarrow d+\pi^+$ between 725 and 1000 MeV ....See Entry 65258

Measurement of analyzing power in the $pp\rightarrow\pi^+d$ reaction ....See Entry 65259

Tensor analyzing power in d-p elastic scattering at backward angles ....See Entry 65270

13.75G Pion-baryon interactions (energy ≤ 10 GeV)

65177 Baryon spectroscopy at LAMPF. B.M.K.Nefkens (Phys. Dept., Univ. of California, Los Angeles, CA, USA).
AIP Conf. Proc. (USA), no.95, p.205-9 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Pion-nucleon elastic scattering at intermediate energy provides a classic example of the importance of spin to the study of strong interactions. An extensive program to determine accurately the πN scattering amplitudes from $p_\pi=247$ to 687 MeV/c is currently carried out at LAMPF by the UCLA Particle Physics Research Group. The author discusses the status of the UCLA program. (10 refs.)

65178 The ωn cusp in π^-p elastic differential cross-section. R.Bhandari (Phys. Dept., New Mexico State Univ., Las Cruces, NM, USA).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.16, p.527-32 (16 April 1983).
The effect of the opening of the ωn channel on the π^-p elastic differential cross-section is investigated. It is shown that, despite the ωn's large production rate, the 10 MeV width of ω is large enough to smear the cusp and render it unobservable as a dramatic effect in the π^-p elastic differential cross-section. This is in sharp contrast to a prominent cusp observed at the ηn threshold. (no refs.)

65179 Remarks on the $\phi\phi$ enhancement observed in $\pi^-p\to\phi\phi n$. S.Minami (Dept. of Phys., Osaka City Univ., Osaka, Japan).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.551-4 (23 April 1983).
It is pointed out that the observed $\phi\phi$ enhancement around 2.2 GeV has something to do with a tensor meson belonging to the Regge trajectory which degenerates with the $\phi'(1680)$ trajectory. (10 refs.)

13.75J Kaon-baryon interactions (energy $\leq$ 10 GeV)

65180 K, π, p scatterings from polarized deuteron at KEK. A.Masaike (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
AIP Conf. Proc. (USA), no.95, p.199-204 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Presents experimental results of the polarization measurement of K^+n elastic and charge exchange scatterings, and the pn elastic scattering at the momenta between 1.06~1.82 GeV/c, using a spin frozen deuteron target. Present status of the measurement of the vector polarization of K^+d and π^+d elastic scattering at KEK is also described. (14 refs.)

65181 Progress report on a study of inelastic K^- reactions with polarized target in the Brookhaven MPS. J.Button-Shafer (Univ. of Massachusetts, Amherst, MA, USA).
AIP Conf. Proc. (USA), no.95, p.226-7 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The University of Massachusetts full-scale polarized-target run with the Brookhaven MPS was successfully carried out in late 1980, many years after being proposed. This study of K^- inelastic processes represents the first application of the 'spin refrigerator' target, and is unusual among polarized-target exeriments in its use of a large multiparticle spectrometer for complex final states. It is also unusual in its emphasis on inelastic channels of $S=-1$ baryon resonances. Analysis of data (at 2.3 GeV c.m.) now in progress will establish the usefulness of the target system and also provide new information for the $SU(6)_W$ (or other) quark model. (3 refs.)

65182 Interference correlations between like pions in the reaction $K^-p\to K^-p\pi^+\pi^+\pi^-\pi^-$ at 8.25 GeV/c. H.Rosaki-Mavrouli, A.Apostolakis, P.Michaelides (Nuclear Phys. Lab., Univ. of Athens, Athens, Greece), J.R.Fry, H.Muirhead, M.Markytan, H.Rohringer, S.Karpathopoulos, M.Mermikides, E.Simopoulou.
Z. Phys. C (Germany), vol.17, no.3, p.189-96 (1983).
The authors have observed correlations in the transverse momentum of pion pairs with like and unlike charge produced in 8.25 GeV/c $K^-p\to K^-p\pi^+\pi^+\pi^-\pi^-$ interaction. They found that a Bose-Einstein interference effect accounts partially for these correlations. Evidence is presented indicating that the correlations observed in the above reaction can be described by the reflections from the occurrence of physical resonances. (14 refs.)

65183 A partial wave analysis of the f' region in the reaction $K^-p\to K\bar{K}\Lambda^0$ at 8.25 GeV/c. M.Baubillier (LPNHE, Univ. of Paris VI, Paris, France), I.J.Bloodworth, A.Burns, J.N.Carney, G.F.Cox, U.Dore, J.B.Kinson, K.Knudson, F.Levy, P.J.Negus, B.Y.Oh, E.Quercigh, J.M.Scarr, G.A.Smith, O.Villalobos Baillie, M.F.Votruba, J.Whitemore, R.Zitoun.
Z. Phys. C (Germany), vol.17, no.4, p.309-17 (1983).
A partial wave analysis of the $K\bar{K}$ system produced by 8.25 GeV/c K^- mesons in the reaction $K^-p\to K\bar{K}\Lambda^0$ has been performed, taking into account the information provided by the Λ^0 decay. The f' region is dominated by $D_0^{(-)}$ and $D_1^{(+)}$ waves. The authors see no evidence for the production of new O^{++} states in the mass region 1.05 to 1.75 GeV. (6 refs.)

13.75L Meson-meson interactions (energy $\leq$ 10 GeV)

On a generalized F. Riesz problem ....See Entry 65069

13.85 HADRON-INDUCED HIGH- AND SUPER-HIGH-ENERGY INTERACTIONS, ENERGY > 10 GEV

(for low energies, see 13.75)

Direct photon production beyond leading log aproximation—$q+q\to\gamma+q+q$ contribution ....See Entry 65176

13.85D Elastic scattering (energy > 10 GeV)

On a generalized F. Riesz problem ....See Entry 65069

Spin effects in large angle two body reactions at high energy ....See Entry 65111

Spin-spin asymmetries in large angle proton-proton elastic scattering ....See Entry 65172

13.85H Inelastic scattering, many-particle final states (energy>10GeV)

Remarks on the $\phi\phi$ enhancement observed in $\pi^-p\to\phi\phi n$ .... See Entry 65179

13.85K Inclusive reactions, including total cross sections, (energy > 10 GeV)

65184 Spin asymmetries in W and Z production at pp and $\bar{p}p$ colliders. J.Lindfors (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).
AIP Conf. Proc. (USA), no.95, p.259-67 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The $SU(2)\times U(1)$ electroweak theory predicts large spin asymmetries in the production of W and Z by polarized hadron beams. In the leptonic decays of W and Z polarized beams could be used to test the coupling of the standard model as well as to study the polarization properties of quarks and gluons. In the hadronic decays of W and Z polarized beams provide a way to extract the weak interaction signal from the dominating QCD background. (13 refs.)

65185 Multiplicity distributions in proton-neutron interactions at 400 GeV/c. D.K.Bhattacharjee, S.K.Ray, P.Sarkar, T.Roy (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Can. J. Phys. (Canada), vol.61, no.4, p.523-31 (April 1983).
Presents a study on the charged multiplicity distribution in proton-neutron (PN) interactions at 400 GeV/c from the data on an exposure of a Fermilab 30-in. deuterium bubble chamber to 400 GeV/c protons. The pn and pp distributions were extracted through an empirical model to correct for double scattering in deuterium. The overall average fraction of the double scattered event is 0.128 ± 0.011. The resulting pn and pp multiplicity distributions give average multiplicities of 8.48 ± 0.10 and 8.99 ± 0.12 respectively. The fraction of pd events which occur off the neutron is 0.52 ± 0.02. The extracted pp distribution parameters are compared with those from the hydrogen bubble chamber (HBC) experiments. Distinctive features of extracted pn distribution are discussed. (18 refs.)

65186 On the transverse momentum of slow protons, deuterons, and pions in high energy interactions. J.B.Singh (Dept. of Phys., Panjab Univ., Chandigarh, India).
Can. J. Phys. (Canada), vol.61, no.4, p.543-9 (April 1983).
A detailed analysis of transverse momentum spectra of slow protons, deuterons, and pions produced in proton emulsion interactions at 400 GeV and π^-C interactions at 40 GeV has been made. Various statistical parameters have been used to test the different forms of the transverse momentum distributions. The nature of the p_T distributions of all the particles is similar in π^--A and p-A interactions at both the energies. (19 refs.)

65187 Measurement of forward and backward mean charged-particle multiplicities in high-energy (pp) soft interactions and comparison with high-energy neutrino and antineutrino deep inelastic scattering. G.Bonvicini, G.Cara Romeo, L.Cifarelli, A.Contin, M.Curatolo, G.D'Ali, C.Del Papa, B.Esposito, P.Giusti, T.Massam, R.Nania, G.Sartorelli, G.Susinno, L.Votano, A.Zichichi (CERN, Geneva, Switzerland).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.555-9 (23 April 1983).
The difference between forward and backward mean charged-particle multiplicities is shown to exist also in (pp) interactions when these are analysed in analogy with the deep inelastic scattering method. The measurements reported here show that this difference, which has been observed for a long time in (νp) and ($\bar{\nu}$p) deep inelastic scattering experiments, is explained in terms of the omitted correction for the leading effect in the backward hemisphere. (24 refs.)

65188 Evidence for the same two-particle correlations in rapidity space in (pp) collisions and (e^+e^-) annihilation. J.Berbieres, G.Bonvicini, G.Cara Romeo, L.Cifarelli, A.Contin, M.Curatolo, G.D'Ali, C.Del Papa, B.Esposito, P.Giusti, T.Massam, R..Nania, G.Natale, F.Palmonari, G.Sartorelli, G.Susinno, L.Votano, A.Zichichi (CERN, Geneva, Switzerland).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.563-8 (23 April 1983).
Evidence is reported for the same two-particle correlations in rapidity space in soft, high-energy (pp) collisions and (e^+e^-) and (e^+e^-) annihilation when the leading baryons' effects are taken into account. (24 refs.)

65189 Fire string model for the large transverse momentum production of lepton pairs in proton-proton collision. P.Catorina (Deipartimento di Fisica, Univ. Bair, Bari, Italy), L.Merola, F.Visco.
Phys. Lett. B (Netherlands), vol.124B, no.1-2, p.117-20 (21 April 1983).
The Fire-String model, which reproduces, without perturbative QCD gluons, all the experimental data about the structure of hadronic final states in e^+e^- annihilation and in hadron-hadron inclusive scattering, is successfully applied to the production of high transverse of high transverse momentum lepton pairs in proton-proton collisions at ISR energies. (11 refs.)

65190 Muon-pair formation in the collision of polarized hadrons. M.P.Rekalo (Kharkov Physicotech. Inst., Acad. of Sci., Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.7, p.663-6 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.88-91 (July 1982). [received: May 1983]
The angular dependence of the differential cross section of muon-pair production in hadron-hadron collisions $a_1+a_2\to\mu^++\mu^-+X$, is investigated in general form, attention being directed mainly toward those contributions to the differential cross section which are determined by the vector polarization of the incident hadron a_1. The specific mechanism of processes $a_1+a_2\to\mu^++\mu^-+X$ is not given in detail, but use is made of such general properties as the conservation of electromagnetic hadron current and the invariance of the electromagnetic interaction of hadrons with respect to spatial reflections. (10 refs.)

65191 Quark recombination in deuteron fragmentation. P.Pal (Uluberia Coll., Howrah, West Bengal, India), P.Dasgupta, N.Dasgupta.
Z. Phys. C (Germany), vol.17, no.3, p.243-8 (1983).
Low-P_T production off deuteron in the fragmentation region is studied on the basis of a six-quark picture of deuteron. It is argued that all six valence quarks participate equally in the hadronization processes associated with meon and baryon productions. The x-distribution of the inclusive cross sections is studied in the framework of a quark recombination model. Fit with experimental data leads to a determination of the valence and sea quark distributions in deuteron. Probabilistic arguments applied to a general recombination picture are shown to lead to some experimentally verifiable constraints on baryon multiplicities. Possibilities of determining the various recombination probabilities are also discussed. (11 refs.)

65192 Prospects of technicolor-signatures in hadronic collisions. K.Grassie (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Z. Phys. C (Germany), vol.17, no.4, p.353-64 (1983).
Within the context of the Dimopoulos' (1980) one family model, the author considers possible technicolor signatures in hadronic reactions at high energies. For the single-production of light color-singlet states (P^0, P^3, $P^\pm$) in $p\bar{p}$ annihilation, the author finds the Compton-scattering process $gc\to P^0c$ most promising. In case of PGB-pair-production, the reaction $p\bar{p}\to P^+P^-$ via the subprocess $q\bar{q}\xrightarrow{\gamma,Z0}P^+P^-$, as well as the production of heavy color-triplets (P_3) in $p\bar{p}\to P_3\bar{P}_3$ via $q\bar{q}$ and gg-fusion at Tevatron-energies, appear to be best suited for detecting these objects. (31 refs.)

65193 Evidence for the t- quark in $\bar{p}p$ collider data. V.Barger, A.D.Martin, R.J.N.Phillips.
Report RL-83-015, Rutherford Appleton Lab., Chilton, Oxon., England (Feb. 1983), 13 pp.
Proposes a simple method to identify semileptonic weak decays $t\to e\nu b$ of any heavy particle t and to determine its mass independent of the t-production mechanism, using $\bar{p}p$ collider events that contain a single electron (or muon) and missing transverse momentum. Events with transverse mass $M_T(e\nu) > 3$ GeV originate either from t-decays of mass $m_t > M_T(e\nu)+m_b$ or from $W\to e\nu$ decays; the latter is a distinctive background that can be subtracted. The $M_T(e\nu)$ distribution of electron events with jets, recently observed in the

UA1 experiment at CERN, may be interpreted as being due to a t-quark with mass 25 to 40 GeV. (7 refs.)

65194 Finding the t- quark in W boson decay debris. V.Barger, A.D.Martin, R.J.N.Phillips.
Report RL-83-016, Rutherford Appleton Lab., Chilton, Oxon., England (Feb. 1983), 13 pp.
Points out a spectacular jet plus electron signature of t-quark production at $\bar{p}p$ colliders via W boson decay $W \to tb$ with subsequent $b \to$ jet, and $t \to be\nu$ decays. The b jet momentum transverse to the beam has a Jacobian peak near $p_T(b)=(M_W^2-m_t^2)/(2M_W)$; this jet is expected to be highly collimated. Electrons from t-decay occur with large momentum components normal to the b jet in the plane transverse to the beam. Both the b Jacobian peak and transverse momenta of the t-decay fragments can be used in making further determinations of m_t. (7 refs.)

Spin physics and inclusive processes at short distances .... See Entry 65109

Electrically neutral quarks: production of fractionally charged hadrons .... See Entry 65122

Inclusive γ-produnction in $\bar{p}p$ interactions at 0.76 and 2.0 GeV/c .... See Entry 65175

Polarization and inclusive reactions: an introduction for the theory workshop [spin physics] .... See Entry 65195

Single spin asymmetry for Drell-Yan dileptons and the chromo-Coulomb phase: a new test of QCD .... See Entry 65196

Spin asymmetries in large P_T production of lepton pairs in the collision of polarized hadrons .... See Entry 65197

On mean number of collisions in high energy hadron-nucleus interaction .... See Entry 65260

13.85M Cosmic ray interactions

(see also 94.40 Cosmic rays)

Formation and signature of quark matter in relativistic ion collisions: evidence from cosmic rays .... See Entry 65227

13.88 POLARISATION IN INTERACTIONS AND SCATTERING

65195 Polarization and inclusive reactions: an introduction for the theory workshop [spin physics]. K.Heller (Univ. of Minnesota, Mineapolis, MN, USA).
AIP Conf. Proc. (USA), no.95, p.320-2 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982). (16 refs.)

65196 Single spin asymmetry for Drell-Yan dileptons and the chromo-Coulomb phase: a new test of QCD. J.P.Ralston (High Energy Phys. Div., Argonne Nat. Lab., Argonne, IL, USA), B.Pire.
AIP Conf. Proc. (USA), no.95, p.329-34 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors discuss the angular distribution $d\sigma/d^4Qd\Omega$ of dileptons produced in collisions in which one hadron is polarized and the other unpolarized. They find that single-spin dependent contributions at measured Q_T are non-zero when imaginary parts from higher order loop graphs are considered, but vanish in the absence of such initial state interactions. They report on a complete calculation in progress in perturbative QCD at $O(\alpha_s^2)$ of the dominant structure function coming from the $q\bar{q} \to \gamma^* + X$ channel. They consider the exponentiation of this result and point out that this would lead to an oscillatory scaling violation. (10 refs.)

65197 Spin asymmetries in large P_T production of lepton pairs in the collision of polarized hadrons. K.Hidaka (Tokyo Gakugei Univ., Tokyo, Japan).
AIP Conf. Proc. (USA), no.95, p.337-41 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The author makes predictions for spin asymmetries in the production of lepton pairs at large p_T from the collision of longitudinally polarized hadrons using QCD and the electroweak gauge model. Asymmetries typically at the 10% level are predicted. The experimental test should be possible in the near future, e.g., at ISABELLE. (12 refs.)

5th High Energy Spin Symposium .... See Entry 64572

Asymmetry parameters in the polarized e-p and e-d scattering within the framework of $SU(2)_L \times U(1) \times U(1)$ and SO(10) gauge models .... See Entry 65095

Qualitative features of fixed angle elastic scattering in perturbative QCD .... See Entry 65110

Spin effects in large angle two body reactions at high energy .... See Entry 65111

Measurement of the polarization of positive muons produced in high-energy antineutrino interactions .... See Entry 65143

Effect of triple gluon coupling in semi-inclusive polarized scattering processes .... See Entry 65156

Nucleon nucleon scattering experiments at SATURNE II .... See Entry 65164

p↑p↑ scattering at SIN .... See Entry 65165

Spin parameter measurements in p-p elastic scattering at 6 and 11.75 GeV/c .... See Entry 65166

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

Recent data in p-p elastic scattering and diproton resonances .... See Entry 65168

Nucleon-nucleon experiments at LAMPF .... See Entry 65169

Measurement of polarization parameters in pp elastic scattering and direct experimental reconstruction of the elastic scattering matrix at 445 MeV .... See Entry 65170

$d\sigma/d\Omega$ and a_y for small angle pp elastic scattering at 1.46 GeV/c .... See Entry 65171

Spin-spin asymmetries in large angle proton-proton elastic scattering .... See Entry 65172

Baryon spectroscopy at LAMPF .... See Entry 65177

K, π, p scatterings from polarized deuteron at KEK .... See Entry 65180

Progress report on a study of inelastic K^- reactions with polarized target in the Brookhaven MPS .... See Entry 65181

Spin asymmetries in W and Z production at pp and $\bar{p}p$ colliders .... See Entry 65184

Muon-pair formation in the collision of polarized hadrons .... See Entry 65190

The polarized beam asymmetry for $\gamma d \to Pn$ in the energy range 0.4-0.8 GeV .... See Entry 65252

Angular and energy dependence of the analyzing power A_{y_0} of the reaction $p+p \to d+\pi^+$ between 725 and 1000 MeV .... See Entry 65258

Measurement of analyzing power in the $pp \to \pi^+d$ reaction .... See Entry 65259

Tensor analyzing power in d-p elastic scattering at backward angles .... See Entry 65270

Dibaryon search in the pi-d system .... See Entry 65293

13.90 OTHER TOPICS IN SPECIFIC REACTIONS AND PHENOMENOLOGY OF ELEMENTARY PARTICLES

65198 Perpendicular $e\nu$ mass from W decay. V.Barger, A.D.Martin, R.J.N.Phillips.
Report RL-83-011, Rutherford Appleton Lab., Chilton, Oxon., England (Jan. 1983), 9 pp.
The authors point out properties of the 'perpendicular $e\nu$ mass', defined in terms of transverse momenta $\vec{p}_T$ by $M_T^2(e\nu)=2|\vec{p}_{eT}||\vec{p}_{\nu T}|-2\vec{p}_{eT}\cdot\vec{p}_{\nu T}$, that make it particularly well suited to W mass and width determinations. They give an analytic expression for its distribution in W production and subsequent $W \to e\nu$ decay at $\bar{p}p$ colliders, accurate to order $\langle p_{WT}^2/M_W^2\rangle \approx 1\%$. A maximum likelihood fit of this formula to the five UA1 events gives $M_W=80.3\pm_3^6$ GeV. (6 refs.)

Compilation of coupling constants and low-energy parameters: 1982 edition .... See Entry 64599

14.00 PROPERTIES OF SPECIFIC PARTICLES AND RESONANCES

Proceedings of the VI High Energy Physics Symposium (papers in summary form only received) .... See Entry 64598

14.20 BARYONS AND BARYON RESONANCES

(inc. antiparticles)

5th High Energy Spin Symposium .... See Entry 64572

Charmed baryon magnetic moments in broken SU(8) model .... See Entry 65077

Neutron oscillations in a periodically varying magnetic field .... See Entry 65081

Proton decay in terms of an effective baryon-lepton transition .... See Entry 65090

n-$\bar{n}$ oscillations in SU(5) GUT and left-right asymmetry .... See Entry 65096

Do mass scales for observable parity restoration and n-$\bar{n}$ oscillation exist in SU(16): .... See Entry 65097

A new subtraction procedure for GUTs and mass scales for parity restoration and n-$\bar{n}$ oscillation in SO(10) .... See Entry 65098

Nuclei as metabags .... See Entry 65130

Spin-dependent hyperfine interactions in the positive-parity non-strange excited baryons .... See Entry 65132

Deformed solutions of the MIT quark bag model .... See Entry 65133

Spectroscopy of charmed baryons .... See Entry 65134

Masses and some electromagnetic properties of charm and b-quark hadrons in a bag model with a variable bag pressure .... See Entry 65136

Neutrino backgrounds in the Kolar Gold Field nucleon decay experiment .... See Entry 65150

The axial form factor of the nucleon and the pion-nucleon vertex function .... See Entry 65152

Dibaryon resonances .... See Entry 65162

Partial wave analysis of $pp \to \pi d$, πd elastic and pp elastic in the dibaryon region .... See Entry 65163

Recent data in p-p elastic scattering and diproton resonances .... See Entry 65168

Progress report on a study of inelastic K^- reactions with polarized target in the Brookhaven MPS .... See Entry 65181

Angular and energy dependence of the analyzing power A_{y_0} of the reaction $p+p \to d+\pi^+$ between 725 and 1000 MeV .... See Entry 65258

Evidence for dibaryon resonances from the measurement of the tensor polarization t_{20} in π^+-d scattering .... See Entry 65292

Dibaryon search in the pi-d system .... See Entry 65293

Antiprotons at CERN .... See Entry 65771

New application of the superthermal Ultra-Cold Neutron source. I. The search for the neutron electric dipole moment .... See Entry 65805

14.40 MESONS AND MESON RESONANCES

5th High Energy Spin Symposium .... See Entry 64572

Meson widths and form factors at intermediate momentum transfer in non-perturbative QCD .... See Entry 65121

The QCD behaviour for the valence quark distribution function of pions in the leading logarithm approximation and relevant differential cross-section .... See Entry 65123

Masses and decay widths of some exotic particles and their implications .... See Entry 65126

Nuclei as metabags .... See Entry 65130

Masses and some electromagnetic properties of charm and b-quark hadrons in a bag model with a variable bag pressure .... See Entry 65136

Decay of glue balls to a pair of mesons .... See Entry 65137

The estimates of the vector and pseudoscalar decay constants .... See Entry 65145

Einstein locality and the $K^0\bar{K}^0$ system .... See Entry 65146

Decay processes in the massive straton model of mesons .... See Entry 65147

Experimental upper limits for hadronic and axion decays of the $\Upsilon(1S)$ ......See Entry 65148

On extracting weak quark couplings from bottom and top decays ......See Entry 65149

Pion and kaon form factors in the statistical model ......See Entry 65151

Study of the ω meson in the VEPP-2M storage ring ......See Entry 65158

Remarks on the $\phi\phi$ enhancement observed in $\pi^- p \to \phi\phi n$ ......See Entry 65179

Subthreshold K^+ production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei ......See Entry 65261

14.60 LEPTONS

Electromagnetic binding with only zero orbital angular momentum, low-energy states ......See Entry 64742

Mass splitting between the supersymmetric partners of quarks and leptons ......See Entry 65075

Non-abelian conformal gravity as the origin of strong interactions ......See Entry 65082

Neutrinoless double beta decay in the case of Dirac neutrinos ......See Entry 65084

An SU(4)⊗SU(2)⊗U(1) unified model ......See Entry 65086

Perpendicular $e\nu$ mass from W decay ......See Entry 65198

Effect of neutrino-oscillations on the fluxes of atmospheric neutrinos ......See Entry 69460

Stellar collapses in the Galaxy ......See Entry 69632

Lepton loss and entropy generation in stellar collapse ......See Entry 69633

Possibility of detecting relict massive neutrinos ......See Entry 69765

The rest mass of neutrinos and clustering in the early Universe ......See Entry 69766

Massive, degenerate neutrinos and cosmology ......See Entry 69771

14.80 OTHER AND HYPOTHETICAL PARTICLES

65199 Spectroscopic search for fractional charge in ultrapure semiconductors. M.J.H.van de Steeg, H.W.H.M.Jongbloets, P.Wyder (Res. Inst. for Materials, Univ. of Nijmegen, Nijmegen, Netherlands).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1234-7 (25 April 1983).
A search for fractional-charge impurities in semiconductors, using photothermal ionization spectroscopy, is described. It is shown that, depending on the concentration of compensating impurities, the detection sensitivity for fractional-charge impurities in ultrapure germanium is 10^7 cm^{-3} in a conventional configuration and, after modification 10^5 cm^{-3}—i.e. one fractional charge per 10^{19} nucleons. From measured spectra of an ultrapure Ge sample it was deduced that it contained less than 1.5×10^{11} cm^{-3} acceptorlike fractional-charge impurities. (16 refs.)

Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2) ......See Entry 64783

Producion of tachyons from Schwarzschild black holes ......See Entry 64803

The 't Hooft-Polyakov monopole near the Prasad-Sommerfield limit ......See Entry 65004

Principal orbits and the Yang-Mills-Higgs model ......See Entry 65018

The monopole's spinor fields ......See Entry 65020

Magnetic-charge conjugation and the topological nature of magnetic monopole ......See Entry 65039

Time-dependent solutions of Yang-Mills equations related to the Wu-Yang magnetic monopole ......See Entry 65048

Surface terms and dual formulations of gauge theories ......See Entry 65050

Mass splitting between the supersymmetric partners of quarks and leptons ......See Entry 65075

Fermion-induced monopole-antimonopole annihilation ......See Entry 65080

Non-abelian conformal gravity as the origin of strong interactions ......See Entry 65082

Classical upper bounds for grand-unified monopole masses ......See Entry 65083

An SU(4)⊗SU(2)⊗U(1) unified model ......See Entry 65086

A comment on the light-fermion mass hierarchy problem in SU(9) grand unified models ......See Entry 65087

Fermions in the SU(5) colorless dyon field ......See Entry 65088

Resolution of compositeness of Higgs bosons ......See Entry 65093

The discovery of a magnetic monopole and its implication for quarks ......See Entry 65100

Interaction of a spin-1/2 tachyon with a spin-1/2 bradyon and a tachyon-bradyon model ......See Entry 65107

Electrically neutral quarks: production of fractionally charged hadrons ......See Entry 65122

Electromagnetic quark mass difference and dynamical symmetry breaking ......See Entry 65125

Masses and decay widths of some exotic particles and their implications ......See Entry 65126

Heavy quarkonium systems in cut-off potential model ......See Entry 65127

Which is lighter—d or u quark? ......See Entry 65129

Decay of glue balls to a pair of mesons ......See Entry 65137

Radiative corrections to Higgs production by $e^+e^- \to ZH$ in the Weinberg-Salam model ......See Entry 65140

Neutrino and antineutrino charged-current inclusive scattering in iron in the energy range $20 < E_\nu < 300$ GeV ......See Entry 65144

Effect of triple gluon coupling in semi-inclusive polarized scattering processes ......See Entry 65156

Charm fragmentation function—a comparison of neutrino and e^+e^- data ......See Entry 65160

Spin asymmetries in W and Z production at pp and $\bar{p}p$ colliders ......See Entry 65184

Evidence for the t- quark in $\bar{p}p$ collider data ......See Entry 65193

Finding the t- quark in W boson decay debris ......See Entry 65194

Perpendicular $e\nu$ mass from W decay ......See Entry 65198

Monopole heat ......See Entry 69495

Parastatistics and the equation of state for the early Universe ......See Entry 69757

Friedmann Universe and superluminal Dirac particles ......See Entry 69763

20.00 NUCLEAR PHYSICS

21.00 NUCLEAR STRUCTURE

21.10 GENERAL AND AVERAGE PROPERTIES OF NUCLEI; PROPERTIES OF NUCLEAR ENERGY LEVELS

(for properties of specific nuclei listed by mass ranges, see 27.)

65200 Quenching of the mass operator associated with collective states in many-body systems. P.F.Bortignon, R.A.Broglia (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark), C.H.Dasso.
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.221-34 (25 April 1983).
Giant resonances are understood as superposition of particle-hole excitations. The empirical systematics indicates that the associated spreading widths are considerably smaller than the sum of typical widths of single-particle and single-hole states, and that the centroid energy is in good agreement with the RPA predictions. These results imply a destructive interference between the different contributions to the mass operator associated with collective vibrations. The authors study the properties of the mechanism responsible for this quenching by inspecting contributions to the mass operator in the semiclassical limit of large single-particle angular momenta. (16 refs.)

65201 High-spin rotational bands and pairing reduction in ^{166}Hf. Y.K.Agarwal, J.Recht, H.Hubel, M.Guttormsen (Inst. fur Strahlen- und Kernphys., Univ. Bonn, Bonn, Germany), D.J.Decman, H.Kluge, K.H.Maier, J.Dudek, W.Nazarewicz.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.199-210 (9 May 1983).
Rotational properties of the ^{166}Hf nucleus have been studied by in-beam spectroscopic methods using the ^{150}Sm(^{20}Ne,4n)^{166}Hf reaction. The ground band was observed up to the $I^\pi = 18^+$ level, the s-band from the $I^\pi = 12^+$ up to $I^\pi = 22^+$ level; in addition two side bands were found. The results are interpreted in terms of the pairing-self-consistent Hartree-Fock-Bogolyubov cranking model. Quantitative agreement between theory and experiment is obtained for the crossing of the ground band and s-band. The calculations predict a reduction of about 50% in the neutron pairing energy gap of yrast states in the crossing region. The kinematical ($\mathcal{J}^{(1)}$) and dynamical ($\mathcal{J}^{(2)}$) moments of inertia are analysed. (10 refs.)

65202 Rotation-alignment effect in ^{198}Hg in an angular-momentum-projected band-mixing calculation. C.R.Praharaj (Inst. of Phys., Bhubaneswar, India), S.B.Khadkikar.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1254-7 (25 April 1983).
The crossing of the ground and the S band and the interaction between these two in ^{198}Hg are studied for states of sharp angular momenta by projection from deformed intrinsic states and subsequent diagonalization. The S band crosses the ground band producing backbend around 8ħ, in agreement with experiment. The spectra as well as the rotation alignment of $i13/2$ neutrons are presented. (14 refs.)

65203 Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei. M.Kortelahti, T.Komppa, M.Piiparinen, A.Pakkanen, R.Komu (Dept. of Phys., Univ. of Jyvaskyla, Jyvaskyla, Finland).
Phys. Scr. (Sweden), vol.27, no.3, p.166-8 (March 1983).
The level structure of the $N=79$ ^{137}Ce nucleus has been studied with the ^{137}Ba(^{3}He,3n) reaction using in beam γ-ray and conversion electron spectroscopoy. The level ordering in the $\nu h_{11/2}{}^{-1} \times 2^+$ multiplet has been discussed on the basis of the triaxial rotor-plus-particle model which suggests a slightly oblate triaxial shape for ^{137}Ce and the prolate-oblate shape transitions in the Ce isotopes to occur between $N=77$ and 79. (15 refs.)

Effect of spin on nuclear shape in deformed even nuclei in the framework of asymmetric rotor model ......See Entry 65207

Magnetic moments in the backbending region of ^{158}Dy ......See Entry 65213

Semiclassical calculation of one-particle, one-hole and two-particle,two- hole level densities ......See Entry 65215

Rotational limit of the interacting two-vector boson model ......See Entry 65221

g-boson excitations in the interacting boson model ......See Entry 65222

Evidence for triton and alpha-particle clustering at high excitation in ^{15}N ......See Entry 65225

Nuclear Gamow-Teller strength in the $\Delta(3,3)$-region ......See Entry 65234

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model ......See Entry 65248

The ^{249}Bk(p,t)^{247}Bk reaction ......See Entry 65264

Inelastic scattering of ^{16}O from ^{60}Ni at 114 MeV ......See Entry 65272

Experiments with sub-nanosecond tandem beam pulses ......See Entry 65840

21.10D Binding energy and masses

65204 The mass of ^{18}N. G.D.Putt, L.K.Fifield, M.A.C.Hotchkis, T.R.Ophel, D.C.Weisser (Dept. of Nuclear Phys., Australian Nat. Univ., Canberra, Australia).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.190-8 (9 May 1983).
States in ^{18}N have been populated with the ^{18}O(^{7}Li,^{7}Be)^{18}N reaction at 52 MeV. The single ground-state peak observed in previous measurements using charge-exchange reactions is shown to be at least a doublet, which leads to a substantial revision of the ground-state mass of ^{18}N. The revised value of the mass excess is 13.116 ± 0.020 MeV. Several excited states of ^{18}N are also observed. (4 refs.)

65205 Accurate determination of the ^{17}O-^{16}O+n coupling constant and spectroscopic factor. S.Burzynski, M.Baumgartner, H.P.Gubler, J.Jourdan, H.O.Meyer, G.R.Plattner, H.W.Roser, I.Sick (Dept. of Phys., Univ. of Basel, Basel, Switzerland), K.-H.Mobius.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.230-40 (9 May 1983).
The authors have measured ^{16}O-^{17}O elastic cross sections at 22 MeV between 65°-140° to ±1%. The observed oscillatory interference between Coulomb scattering and the neutron transfer process is analyzed using exact finite-range DWBA. A model-independent value of $C^2=0.82\pm0.07$ is obtained for the coupling constant of the $1d_{5/2}$ neutron in ^{17}O. They also present an analysis of data on magnetic electron scattering from ^{17}O, which yields precise information on the magnitude and the radial shape of the $1d_{5/2}$ neutron bound-state wave function. With this they relate the coupling constant to the spectroscopic factor and find $S=1.06\pm0.11$. It is shown that the magnetic electron scattering data alone yield $S=1.04\pm0.10$. Combining these results with earlier work the authors recommend $C^2=0.79\pm0.04$ and $S=1.03\pm0.07$ as best values. This spectroscopic strength corresponds to (91±7)% of the full single-particle value. (19 refs.)

65206 A study on the binding problem of Δ(1232) in nuclei with the Hartree-Fock method. Shi Xiang-jun (Inst. of Atomic Energy, Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.76-85 (Jan. 1983). In Chinese.
The binding problem of isobar Δ(1232) in $_{\Delta}{}^{4}$He, $_{\Delta}{}^{12}$C and $_{\Delta}{}^{16}$O systems is studied in detail by the Hartree-Fock method. The OBEP is used for the nucleon-nucleon potential and the nucleon-Δ(1232) interaction. The calculated results show that Δ(1232) can be bound only in $_{\Delta}{}^{4}$He and not in the $_{\Delta}{}^{12}$C and $_{\Delta}{}^{16}$O systems. (9 refs.)

D-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems .... See Entry 65209

The $A=6$ isobaric triplet .... See Entry 65224

Mass formulae for Λ-hypernuclei .... See Entry 65228

The spectroscopy of a four-baryon system .... See Entry 65229

Large transverse momentum transfer at 1 GeV proton disintegration of ^{238}U target .... See Entry 65269

21.10F Shape, charge, radius and form factors

65207 Effect of spin on nuclear shape in deformed even nuclei in the framework of asymmetric rotor model. V.P.Varshney, K.K.Gupta, D.K.Gupta (Dept. of Phys., Arga Univ., Aligarh, India), A.K.Chaubey.
Indian J. Pure & Appl. Phys., vol.20, no.10, p.799-803 (Oct. 1982). [received: April 1983]
The existence of static triaxial shape has been investigated in the framework of the Davydov et al (1964) model. The assumption of rigid shape of the nucleus with fixed shape parameters β and γ proves to be satisfactory as an approximation to the actual nuclear wave functions up to spin 4. But at spin 6, the nucleus gets rid of its rigid shape, attains more freedom and the γ-vibrations begin to influence the shape of the nucleus. This fact implies appreciable dynamic triaxiality for most of the even nuclei at higher angular momentum and differs from viewpoint of RJ Turner and T Kishimoto [Nucl. Phys (Netherlands), 217 (1973) 317] about the abrupt phase transition of the rotational mode from axially symmetric to asymmetric shape at $I=8$. (23 refs.)

65208 Shell (deformation) effect in the nuclear charge radius. Zeng Jinyan, C.Y.Tseng (Dept. of Phys., Peking Univ., China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.101-8 (Jan. 1983). In Chinese.
It is shown that, without exception, the observed RMS charge radius constants of strongly deformed nuclei, $r_p's$, are a little larger than those of the neighbouring spherical nuclei. The local variations among the charge radii of the sequence of isotopes, the incomplete neutron shells [$1p_{3/2}(N\sim3\text{-}6)$, $1d_{5/2}$, $(N\sim9\text{-}14)$, $1f_{7/2}(N\sim20\text{-}28)$, $1g_{9/2}(N\sim40\text{-}50)$, $1h_{11/2}$, $(N\sim70\text{-}82)$], display some peculiar behaviors (e.g. RMS charge radii decrease with increasing A) which are sharply conflicting with the traditional $A^{1/3}$-law. Taking the deformation effect into account, these strange variations can be accounted for with $Z^{1/3}$-law. (36 refs.)

65209 D-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems. J.J.Bevelacqua (USDOE, Oak Ridge, TN, USA).
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.203-16 (Feb. 1983).
Trinucleon wave functions, based on the generalized R-matrix methodology of Lane and Robson (1966, 1969), have been previously shown to provide representative binding energies, charge radii, and S-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems. Herein, R-matrix predictions of D-wave asymptotic normalization constants, asymptotic normalization constant ratios, and D-wave parameters are calculated in order to more fully evaluate the adequacy of model wave functions. The R-matrix calculations generally reproduce the ranges of the data and suggest that model trinucleon wave functions are representative of the ^{3}H and ^{3}He systems and will be useful in studies of (d,^{3}H), (d,^{3}H), and other transfer reactions involving ^{3}He or ^{3}He. (43 refs.)

65210 Magnetic form factor of ^{49}Ti at high momentum transfer. T.Suzuki (Dept. of Phys., Nihon Univ., Tokyo, Japan).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.262 vol.2
Effects of core polarization and mesonic exchange currents are investigated in the magnetic form factor of ^{49}Ti(e,e)^{49}Ti at high momentum transfer region: $q_{eff}\gtrsim2$ fm^{-1}. (4 refs.)

Rotation-alignment effect in ^{198}Hg in an angular-momentum-projected band-mixing calculation .... See Entry 65202

Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei .... See Entry 65203

Rotational limit of the interacting two-vector boson model .... See Entry 65221

Deformation effect in the fast neutron total cross section of aligned ^{59}Co .... See Entry 65249

Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei .... See Entry 65262

The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg .... See Entry 65273

21.10H Spin, parity, and isobaric spin

Effect of spin on nuclear shape in deformed even nuclei in the framework of asymmetric rotor model .... See Entry 65207

Measurement of B(E2)↑ values of the $5/2_2{}^-$ states of ^{107,109}Ag from the Coulomb excitation with protons .... See Entry 65231

Microscopic calculations in odd-odd nuclei .... See Entry 65232

The decay of ^{100}Ag .... See Entry 65238

Spin polarization in ^{20}Ne+^{168}Er collisions at 13.5 MeV/N .... See Entry 65250

An experimental test of charge symmetry in n-p elastic scattering .... See Entry 65257

Angular momentum transfer in deep inelastic collisions: alignment and misalignment of fragment spin .... See Entry 65289

Stellar reaction rate of ^{20}Ne(α,γ)^{24}Mg .... See Entry 69602

21.10J Spectroscopic factors

65211 (^{6}Li,d) reactions on ^{24}Mg and ^{26}Mg at 73 MeV. T.Tanabe, K.Haga, M.Yasue, K.Sato (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan), K.Ogino, Y.Kadota, M.Tochi, K.Makino, T.Kitahara, T.Shiba.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.241-58 (9 May 1983).
The ^{24,26}Mg(^{6}Li,d)^{28,30}Si reactions have been studied at 73 MeV bombarding energy. The angular distributions were analyzed with exact finite-range distorted wave Born approximation calculations assuming a direct α-cluster transfer. Extracted spectroscopic strengths leading to low-lying levels of ^{28}Si and relative spectroscopic strengths between transitions to ^{28}Si and ^{30}Si ground states are consistent with those previously obtained by several α-transfer reactions. Many strongly populated levels have been observed at $E\gtrsim10$ MeV for ^{28}Si. A marked similarity was found between the deuteron spectrum and the ^{24}Mg(α,α)^{24}Mg excitation function in this excitation energy region. A brief comparison of the present α-transfer results with previous two-nucleon transfer data leading to ^{28,30}Si is also presented. (37 refs.)

Accurate determination of the ^{17}O-^{16}O+n coupling constant and spectroscopic factor .... See Entry 65205

Reaction ^{48}Ca (p,n) ^{48}Sc from $E_p=1.885$ to 5.1 MeV .... See Entry 65267

21.10K Electromagnetic moments

65212 Nuclear magnetic moment of the 3.9 s $^{11}/_2{}^-$ isomer ^{193m}Au. E.Hagn, E.Zech (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.83-93 (9 May 1983).
The magnetic hyperfine splitting of ^{193m}Au ($J^\pi={}^{11}/_2{}^-$, $E=290$ keV; $T_{1/2}=3.9$ s) as a dilute impurity in Ni has been measured with nuclear magnetic resonance on oriented nuclei. With the known hyperfine field corrected for hyperfine anomalies the g-factor and magnetic moment of ^{193m}Au are deduced. (22 refs.)

65213 Magnetic moments in the backbending region of ^{158}Dy. G.Seiler-Clark, D.Pelte (Phys. Inst., Univ. Heidelberg, Heidelberg, Germany), H.Emling, A.Balanda, H.Grein, E.Grosse, R.Kulessa, D.Schwalm, H.J.Wollersheim, M.Hass, G.J.Kumbartzki, K.-H.Speidel.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.211-29 (9 May 1983).
Yrast levels in the backbending region of ^{158}Dy were Coulomb excited with a 4.7 MeV/u ^{208}Pb beam. Employing the transient field technique with a thin magnetized iron foil, the precessions of the angular correlations of decay γ-rays from levels up to spin $I^{\pm}=16^+$ were measured. The results show a clear reduction of the g-factor for states in the backbending region relative to that of the low-spin levels, thus demonstrating that the backbending in ^{158}Dy is mainly caused by the alignment of $i_{13/2}$ neutrons. In a similar experiment, precession measurements on Coulomb excited low-spin levels of ^{164}Dy served to determine the static hyperfine field of Dy in Fe and the g-factor of the 6$^+$ state in ^{164}Dy. (22 refs.)

21.10M Level density and structure

65214 ^{9}Be+p elastic scattering at $2\leq E_p\leq5$ MeV and levels in ^{10}B. M.Allab, A.Boucenna, M.Haddad (Centre des Sci. et de la Technol. Nucleaires, Alger, Algeria).
J. Phys. (France), vol.44, no.5, p.579-88 (May 1983).
Absolute differential cross sections of the ^{9}Be+p elastic scattering have been measured between 2 and 3.8 MeV proton laboratory energy. Excitation curves at five angles between $\theta_{cm}=65°$ and 160°C and angular distributions at $E_p=2.31$, 2.44, 2.56, 2.62 and 2.73 MeV for $\theta_{cm}=40°$ to 140° have been obtained. These results together with the previous measurements at $E_p\leq5$ MeV have been compared with the calculations performed in the R-matrix formalism. A good fit has been achieved by introducing nine ^{10}B levels at the excitation energies $E_x=8.45$, 8.66, 8.78, 8.880, 8.892, 8.93, 10.00, 10.36 and 10.83 MeV. Resonance parameters for these levels have been deduced and compared with the existing values and, in some cases, with those of the analogous states in ^{10}Be. (33 refs.)

65215 Semiclassical calculation of one-particle, one-hole and two-particle,two- hole level densities. G.Ghosh, R.W.Hasse (Inst. Laue-Langevin, Grenoble, France), P.Schuck, J.Winter.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1250-3 (25 April 1983).
One-particle, one-hole and two-particle, two-hole level densities are calculated in the local-density, i.e., Thomas-Fermi, approach. For the harmonic oscillator this leads to analytical expressions which are in excellent agreement with the exact quantum results. (8 refs.)

The mass of ^{18}N .... See Entry 65204

Magnetic moments in the backbending region of ^{158}Dy .... See Entry 65213

Investigation of parity violation in ^{19}F .... See Entry 65230

Measurement of B(E2)↑ values of the $5/2_2{}^-$ states of ^{107,109}Ag from the Coulomb excitation with protons .... See Entry 65231

Search of the chemical change of the ^{119m}Sn ($T_{1/2}=293$ days) radioactive decay rate .... See Entry 65236

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model .... See Entry 65248

The ^{249}Bk(p,t)^{247}Bk reaction .... See Entry 65264

The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg .... See Entry 65273

Experiments with sub-nanosecond tandem beam pulses .... See Entry 65840

21.30 NUCLEAR FORCES

(see also 13.75C Nucleon-nucleon interactions)

65216 A folded diagram method for deriving an energy-independent nucleon-nucleon potential from meson exchange. I. Theory. Li Guang-lie (Inst. of High Energy Phys., Acad. Sinica, Peking, China), K.K.Ng, T.T.S.Kuo.
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.67-75 (Jan. 1983). In Chinese.
A folded diagram method for deriving an energy-independent nucleon-nucleon (N-N) potential from meson exchange is proposed. The potential obtained by this method contains not only the irreducible diagrams but also the mesonic folded diagrams, and it is proved that all stretched diagrams are not contained in this potential. (12 refs.)

65217 Nucleon momentum widths in ^{10}B from projectile fragmentation at 32 MeV/u. R.K.Choudhury, M.N.Namboodiri, J.B.Natowitz, K.Hagel, L.Adler, P.Gonthier, H.Simon, S.Kniffen, R.Patton, E.Tomasi, C.Ngo, C.Mazur, M.Ribrag (Cyclotron Inst., Texas A&M Univ., College Station, TX, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.88
The authors have measured inclusive energy spectra of isotopes of all elements from H to B in the reactions of 32 MeV/u ^{10}B with ^{181}Ta. The forward angle spectra show a high energy component peaking at velocities slightly below the projectile velocity. This component can be characterized by a temperature of 1.7 to 2 MeV or alternatively, by a nucleon momentum width, σ_0-40 MeV/c. This value is comparable to the results of recent measurements for reactions at 20 MeV/u ^{20}Ne with ^{197}Au. In contrast, recent measurements on reactions with 43 MeV/u ^{20}Ne projectiles gave a temperature of 8 MeV (or σ_0-85 MeV/c) which is equal to the result obtained at relativistic energies. Thus, a rapid transition in temperature seems to occur between 32 and 43 MeV/u. (4 refs.)

65218 Is parametrization of particle-hole interaction by g′ good?. T.Suzuki (Dept. of Phys., Nihon Univ., Tokyo, Japan).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.263-4 vol.2
The author studies the validity of the parametrization of a particle-hole interaction by the Migdal parameter g′. Taking one-pion and one-rho meson exchange potential for the p-h interaction, $V(r)=(V_\pi(r)+V_\rho(r))g(r)$, where $g(r)$ is the short-range correlation function obtained from the Reid potential, he investigates if one can parametrize the short-range correlation and the exchange part of the matrix elements by a short-range $g'(\vec{\sigma}.\vec{\sigma})(\vec{\tau}.\vec{\tau})f^2/\mu^2 v_\pi(q)$ term; $v_\pi(q)=(1+q^2/\Lambda^2)^{-1}$. (1 ref.)

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

$^1S_0$-state nucleon-nucleon phase shifts due to solitary-wave exchange potentials .... See Entry 65173

A study on the binding problem of Δ(1232) in nuclei with the Hartree-Fock method .... See Entry 65206

Mutual support of magicities and residual effective interactions near ^{208}Pb .... See Entry 65219

Correlated basis theory of nucleon optical potential in nuclear matter .... See Entry 65226

An effective interaction for inelastic scattering derived from the Paris potential .... See Entry 65244

The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg ... See Entry 65273

21.40 FEW-NUCLEON SYSTEMS

D-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems .... See Entry 65209

21.60 NUCLEAR-STRUCTURE MODELS AND METHODS

(for hadronic atoms and molecules, see 36.10)

Nuclei as metabags .... See Entry 65130

D-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems .... See Entry 65209

Semiclassical calculation of one-particle, one-hole and two-particle,two- hole level densities .... See Entry 65215

A folded diagram method for deriving an energy-independent nucleon-nucleon potential from meson exchange. I. Theory .... See Entry 65216

Unitary theory of the baryon-system .... See Entry 65233

21.60C Shell model

65219 Mutual support of magicities and residual effective interactions near ^{208}Pb. N.Zeldes, T.S.Dumitrescu, H.S.Kohler (Niels Bohr Inst., Copenhagen, Denmark).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.11-50 (9 May 1983).
The authors summarize experimental evidence in the lead region on the increased stability associated with neutron magic number when the proton number is magic, and vice versa. The effect is interpreted in the framework of the nuclear shell model with empirical effective interactions. Its relation to spherical Hartree-Fock calculations is pointed out and used to test Skyrme-type forces. None of the considered Skyrme interactions reproduce the effect. (38 refs.)

Shell (deformation) effect in the nuclear charge radius .... See Entry 65208

21.60E Collective models

65220 Intrinsic Lie group and nuclear collective rotation about intrinsic axes. Jin-Quan Chen, Fan Wang, Mei-Juan Gao (Dept. of Phys., Nanjing Univ., Nanjing, China).
J. Phys. A (GB), vol.16, no.7, p.1347-60 (11 May 1983).
For any Lie group G, is so called intrinsic Lie group $\bar{G}$ is introduced, G and $\bar{G}$ being commutative and anti-isomorphic. It is shown that in the parameter space of a Lie group G, the corresponding intrinsic Lie group $\bar{G}$ is just the second parameter group. The general relations between the first and second parameter groups are derived in a simple way. For the group SO(3), there is the intrinsic Lie group $\bar{S}\bar{O}(3)$. The infinitesimal generators of $\bar{S}\bar{O}(3)$ are precisely the components of the angular momentum in the intrinsic coordinate system. Therefore the intrinsic Lie group $\bar{S}\bar{O}(3)$ provides an appropriate mathematical formalism for the description of collective rotations of nuclei about their intrinsic axes. (37 refs.)

65221 Rotational limit of the interacting two-vector boson model. A.Georgieva, P.Raychev, R.Roussev (Inst. of Nuclear Res. & Nuclear Energy, Acad. of Sci., Sofia, Bulgaria).
J. Phys. G (GB), vol.9, no.5, p.521-34 (May 1983).
The rotational limit of the interacting two-vector-boson model is investigated. This limit arises if the Hamiltonian is ‘pseudospin’ invariant and corresponds to the following reduction chain of subgroups: $U(6)\supset U(3)\oplus U(2)\supset O(3)$. Analytic relations for the energies and E2 transition probabilities within the ground-state band, the β and γ vibrational bands and between the vibrational bands for the strongly deformed even-even nuclei are obtained. (19 refs.)

65222 g-boson excitations in the interacting boson model. K.Heyde, P.van Isacker, M.Warroquier, G.Wenes, Y.Gigase (Inst. for Nuclear Phys., Gent, Belgium), J.Stachel.
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.235-252 (25 April 1983).
The authors have extended the interacting boson model (IBM) by including the g-boson degree of freedom. Schematic model calculations have been carried out in the two different limits: SU(5) and O(6). Particular applications have been carried out for ^{104}Ru, a nucleus intermediate between SU(5) and O(6). In all cases, energy spectra, E2 and E4 transition rates have been studied in detail and compared with the most recent experimental data for ^{104}Ru. (33 refs.)

65223 Separation of variables in O(3)-invariant wave equations for quadrupole coordinates. A.V.Konarev (Inst. of Control Problems, Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.655-9 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.80-3 (July 1982). [received: May 1983]
Linear, O(3) invariant equations for a multicomponent wave function, which depends on quadrupole coordinates, are examined. Vibrational, rotational, and spin parts in the Hamiltonian are separated, on which basis angular and internal variables are separated. (6 refs.)

Quenching of the mass operator associated with collective states in many-body systems .... See Entry 65200

High-spin rotational bands and pairing reduction in ^{166}Hf .... See Entry 65201

Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei .... See Entry 65203

Effect of spin on nuclear shape in deformed even nuclei in the framework of asymmetric rotor model .... See Entry 65207

Collective coordinates as open systems. II. Time-scale for pure-state propagation .... See Entry 65247

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model .... See Entry 65248

The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg ... See Entry 65273

Fission barriers of Pb nuclei at high angular momentum .... See Entry 65296

21.60F Models based on group theory

65224 The $A=6$ isobaric triplet. G.Nagels (Dept. of Maths., Melbourne Univ., Melbourne, Victoria, Australia).
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.253-68 (25 April 1983).
A three-body model and phenomenological local potentials are used to study the $A=6$ isobaric triplet. The α-nucleon potential allows an unphysical bound s-state, the effects of which are removed by an orthogonality condition. A variational method is used, and trial functions are found which allow the analytic evaluation of all required integrals. A number of different phenomenological nucleon-nucleon potentials are used, and it is found that while the absolute energy levels are only approximately correct, the level splitting is very close to experimental values. (22 refs.)

Intrinsic Lie group and nuclear collective rotation about intrinsic axes .... See Entry 65220

Rotational limit of the interacting two-vector boson model .... See Entry 65221

g-boson excitations in the interacting boson model .... See Entry 65222

Separation of variables in O(3)-invariant wave equations for quadrupole coordinates .... See Entry 65223

The spectroscopy of a four-baryon system .... See Entry 65229

21.60G Cluster models

65225 Evidence for triton and alpha-particle clustering at high excitation in ^{15}N. A.A.Pilt (Tandem Accelerator Lab., McMaster Univ., Hamilton, Ontario, Canada).
Nuovo Cimento A (Italy), vol.74A, ser.2, no.2, p.185-97 (21 March 1983).
The results of some recent experiments populating multiparticle-multihole states in ^{15}N are reinterpreted in the light of the cluster model. Many of the levels strongly excited in three- and four-nucleon transfer reactions are shown to be good candidates for ^{12}C+t and ^{11}B+α cluster states. The triton cluster structure in ^{15}N is similar to that in ^{19}F, indicating that clustering is stable over a wide mass range. Some mixing between triton and alpha cluster states may exist. (25 refs.)

Extraction of the preformation probability of an α-cluster at the surface of heavy nuclei by means of α-transfer reactions leading to the continuum states .... See Entry 65275

The subthreshold mechanism of the ^{6}Li+^{6}Li→3 α reaction at low energy .... See Entry 65276

21.60J Hartree-Fock and random-phase approximations

Quenching of the mass operator associated with collective states in many-body systems .... See Entry 65200

High-spin rotational bands and pairing reduction in ^{166}Hf .... See Entry 65201

Rotation-alignment effect in ^{198}Hg in an angular-momentum-projected band-mixing calculation .... See Entry 65202

A study on the binding problem of Δ(1232) in nuclei with the Hartree-Fock method .... See Entry 65206

Mutual support of magicities and residual effective interactions near ^{208}Pb ....See Entry 65219

Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei ....See Entry 65262

21.65 NUCLEAR MATTER

65226 Correlated basis theory of nucleon optical potential in nuclear matter. S.Fantoni, B.L.Friman, V.R.Pandharipande (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.51-65 (9 May 1983).
The authors give a brief and simple outline of correlated basis perturbation theory and use it to study the optical potential of nucleons in nuclear matter. The correlated basis functions (CBF) are generated with two-body correlation operators having central, spin, isospin, tensor and spin-orbit terms and realistic nuclear interactions are used to construct the Hamiltonian matrix. The zeroth-order term in the CBF perturbation expansion is given by the variational method, and there are no first-order contributions. The second-order CBF correction to the binding energy is calculated. The real and imaginary parts $U(\rho,e)$ and $W_0(\rho,e)$ of the energy-dependent nucleon optical potential in nuclear matter are calculated at the equilibrium density ρ_0 and at $\rho={}^1/_2\rho_0$. The second-order terms have a relatively small effect on $U(\rho,e)$, but they enhance the nucleon effective mass at $k=k_F$ from its variational values of $0.64m$ and $0.78m$ to $0.81m$ and $1.0m$ at $\rho=\rho_0$ and ${}^1/_2\rho_0$ respectively. The calculated U and W_0 are in fairly good agreement with empirical data. (31 refs.)

65227 Formation and signature of quark matter in relativistic ion collisions: evidence from cosmic rays. J.Cleymans, M.Dechantsreiter, F.Halzan (Phys. Dept., Univ. of Wisconsin, Madison, WI, USA).
Z. Phys. C (Germany), vol.17, no.4, p.341-52 (1983).
Exclusively using experimental information on particle production in nucleon-nucleon interactions, the paper attempts to demonstrate that: (*i*) the characteristics of relativistic collisions between heavy nuclei are determined by quark physics, not conventional nuclear physics; (*ii*) the formation of quark matter in such collisions can be observed experimentally via large multiplicities, copious production of photons (not from π^0 decay), the anomalous strangeness, charm and baryon number structure of the events, and appearance of structure in the rapidity distribution; (*iii*) the formation of quark matter has actually been observed in high energy cosmic ray interactions. The authors show that the 100 TeV threshold for the appearance of anomalous interactions reflects the transition from nucleonic to quark structure of the nucleus. Observed anomalies match the signatures of quark matter formation in (ii); (*iv*) their results imply the abundant presence of heavy nuclei, e.g. Fe, in the high energy cosmic ray spectrum. Cosmic ray interactions above 100 TeV can eventually be used to study the vacuum structure of quantum chromodynamics and the disappearance of spontaneous symmetry breaking due to the restoration of symmetry at higher matter densities. (55 refs.)

A kinetic flow analysis of streamer chamber data for Ne on NaF and Ar on Pb_3O_4 ....See Entry 65286

21.80 HYPERNUCLEI

65228 Mass formulae for Λ-hypernuclei. K.Kar, J.C.Parikh (Phys. Res. Lab., Ahmedabad, India).
Pramana (India), vol.19, no.6, p.555-64 (Dec. 1982). [received: April 1983]
Simple considerations regarding the Hamiltonian and the ground state wavefunctions of Λ-hypernuclei are used to derive several mass formulae. The parameters that occur in the mass formulae are determined by fitting the experimental binding energies. Information regarding the various interactions in hypernuclei is deduced from the values of these parameters. The 'best' mass formula is further used to predict energies of other light hypernuclei. Relationships between binding energies are also suggested and checked with observed data. (12 refs.)

65229 The spectroscopy of a four-baryon system. Wang Wei-wei (Inst. of Theoretical Phys., Acad. Sinica, Peking, China), Zhang Yu-shun, Pan Ji-zhi, Wang Ru-ling.
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.109-13 (Jan. 1983). In Chinese.
Using $SU(6)$ symmetry theory, the four-baryon system is discussed and a method of analyzing experimental spectra is provided. As the ground states of ${}_{\Lambda\Lambda}{}^4$H, ${}_{\Lambda\Lambda}{}^4$He, ${}_{\Lambda}{}^4$H, ${}_{\Lambda}{}^4$He and ^{4}He are in the same IR of $SU(6)$, one can derive masses for ${}_{\Lambda\Lambda}{}^4$H and ${}_{\Lambda\Lambda}{}^4$He from the experimental data of ${}_{\Lambda}{}^4$H, ${}_{\Lambda}{}^4$He and ^{4}He. Calculations show that these $J^\pi=0^+$ double Λ hypernuclei ${}_{\Lambda\Lambda}{}^4$H and ${}_{\Lambda\Lambda}{}^4$He are not likely bound states. (12 refs.)

Unitary theory of the baryon-system ....See Entry 65233

21.90 OTHER TOPICS IN NUCLEAR STRUCTURE

Conclusions to be drawn from the workshop on future directions in electromagnetic nuclear physics ....See Entry 65251

23.00 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS

(see also 82.55 Radiochemistry)

23.20 ELECTROMAGNETIC TRANSITIONS

65230 Investigation of parity violation in ^{19}F. K.Elsener, W.Gruebler, V.Konig, C.Schweizer, P.A.Schmelzbach, J.Ulbricht, F.Sperisen, M.Merdzan (Lab. fur Kernphys., EHT, Zurich, Switzerland).
AIP Conf. Proc. (USA), no.95, p.162-4 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The parity violating asymmetry A_γ of the radiation from the first excited state of polarized $^{19}F^*$(110 keV) has been measured with particular care to avoid systematical errors and is found to be $A_\gamma=(4.5\pm3.6).10^{-5}$. (8 refs.)

65231 Measurement of B(E2)↑ values of the $5/2_2^-$ states of ^{107,109}Ag from the Coulomb excitation with protons. M.B.Chatterjee (Saha Inst. of Nuclear Phys., Calcutta, India), B.B.Baliga, R.Bhattacharya.
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.2, p.65-72 (1983).
From the Coulomb excitation of natural silver with protons B(E2)↑ values were measured for the $5/2_2-$ states of ^{107,109}Ag using high resolution gamma-ray spectroscopy. B(E2)↑ values of all the observed states have been measured including the $5/2_2^-$ states. The observed and derived properties of the low-lying states of ^{107,109}Ag nuclei are tabulated. (17 refs.)

65232 Microscopic calculations in odd-odd nuclei. S.V.Moholkar, C.S.Warke (Tata Inst. of Fundamental Res., Bombay, India), M.R.Gunye.
J. Phys. G (GB), vol.9, no.5, p.535-43 (May 1983).
The energy spectra in the two even-parity bands $K^\pi=3$ and 4^+ and the two odd-parity bands $K^\pi=0^-$ and 1^- in the doubly-odd nucleus ^{168}Tm are studied in the framework of the microscopic method of variation after angular momentum projection with conservation of nucleon number in each projected state. The calculated energy spectra of the four bands in ^{168}Tm are in good agreement with the corresponding experimental data. (12 refs.)

65233 Unitary theory of the baryon-system. Wang Wei-wei (Inst. of Theoretical Phys., Acad. Sinica, Peking, China), Zhang Yu-shun, Li Yang-guo, Ruan Tu-nan.
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.57-66 (Jan. 1983). In Chinese.
A method of how to extend the baryon unitary theory to the baryon system is systematically introduced. Using the baryon-system $SU(6)$ theory, the spectroscopy of light nuclei and light Λ hypernuclei is discussed. When the Λ degree of freedom is frozen, this theory is in agreement with Wigner's supermultiplet theory. (21 refs.)

65234 Nuclear Gamow-Teller strength in the Δ(3,3)-region. H.Brunig, K.Klingenbeck (Inst. for Theoretical Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.76
Single charge exchange reactions like (p,n) or (^{3}He,t) are particularly suited tools to investigate Gamow-Teller transitions in complex nuclei, both at low and at intermediate energies. In the proper range of energy transfer the Δ(3,3) resonance dominates the nuclear excitation pattern. The influence of the ΔN-interaction on the nuclear excitation spectrum, in particular the occurrence of collective multipole excitations, has been studied in the framework of the Isobar-Doorway (A^*,Δ-hole) model which has already been applied successfully to pion-, photo- and electro-induced reactions in the Δ(3,3) region. It turns out that the ΔN-dynamics significantly modify the multipole spectrum of a complex nucleus compared to a simple quasifree picture. Qualitatively similar effects are expected to show up in the nuclear response function for charge exchange reactions. This is demonstrated for the sample of the inclusive (^{3}He,t) reaction on ^{12}C which has recently been studied at SATURNE for various incident energies. (3 refs.)

65235 Excitation of continuum states in heavy-ion collisions. H.Lenske, S.Landowne, H.H.Wolter, T.Udagawa (Sektion Phys., Univ. Munchen, Garching, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.77
Recently direct reaction theory has been applied to light- and heavy-ion reactions leading to continuum states. The authors use this approach to study inelastic collisions involving light heavy ions where polarizations have been measured. The double differential cross sections are calculated in this approach as the sum of one- and two-step cross sections. $^{48}T_2(^{16}O,^{16}O^1)$ is used as an example. (2 refs.)

Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei ....See Entry 65203

(^{6}Li,d) reactions on ^{24}Mg and ^{26}Mg at 73 MeV ....See Entry 65211

Magnetic moments in the backbending region of ^{158}Dy ....See Entry 65213

Rotational limit of the interacting two-vector boson model ......See Entry 65221

g-boson excitations in the interacting boson model ....See Entry 65222

The spectroscopy of a four-baryon system ....See Entry 65229

Spin polarization in ^{20}Ne+^{168}Er collisions at 13.5 MeV/N .....See Entry 65250

The relative contributions of positive and negative-angle scattering in ^{86}Kr-induced reactions ....See Entry 65290

Stellar reaction rate of $^{20}Ne(\alpha,\gamma)^{24}Mg$ ....See Entry 69602

23.20C Lifetimes and transition probabilities

65236 Search of the chemical change of the ^{119m}Sn ($T_{1/2}$=293 days) radioactive decay rate. K.Makariunas, E.Makariuniene, A.Dragunas (Inst. of Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.237-48 (Feb. 1983).
The differences in decay rates of the nuclear isomer ^{119m}Sn ($T_{1/2}$=293 days; the strongly converted M4 transition) have been measured for different chemical compounds. The experimental results show that the ^{119m}Sn nuclei in the telluride SnTe decay faster then in the metal β-Sn and in the dioxide SnO_2 [the relative change $\Delta\lambda/\lambda$ of the decay probability λ is $+(3.6\pm1.4)\times10^{-4}$]. No measurable difference between the decay rates of ^{119m}Sn in β-Sn and SnO_2 has been observed [$(\Delta\lambda/\lambda)=-(0.1\pm1.2)\times10^{-4}$], irrespective of the great difference in electronic structure of the tin atoms. The results cannot be explained by considering the internal conversion of the valence electrons only. It is necessary to assume that the chemical changes of the decay rate are strongly influenced by the chemical changes of the probabilities of the internal conversion of electrons of the inner shells of the atom. This conclusion is confirmed by theoretical calculations. They show that for the deep inner subshells the relative changes $\Delta\alpha_{nlj}/\alpha_{nlj}$ of the internal conversion coefficients α_{nlj} are much greater than the relative changes $\Delta\rho_{nlj}/\rho_{nlj}$ of the electron densities near the nucleus ρ_{nlj}. (22 refs.)

65237 Half-life measurements of excited levels in ^{157,159,161}Er. V.Berg, J.Oms (Inst. de Phys. Nucleaire, Orsay, France), M.C.Abreu, K.Fransson, Hu Zhaomin.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.119-30 (9 May 1983).
Half-lives of several low-lying levels in ^{157,159,161}Er have been measured using isotopically separated sources of Tm produced by the ISOCELE facility at Orsay, France. Delayed coincidences between internal conversion electrons or between conversion electrons and gamma quanta have been registered. Absolute reduced transition probabilities of γ-transitions have been deduced and compared with single-particle estimates and theoretical values found from model calculations including the Coriolis mixing of states. (14 refs.)

Effect of spin on nuclear shape in deformed even nuclei in the framework of asymmetric rotor model ....See Entry 65207

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model ....See Entry 65248

23.20N Internal conversion and extranuclear effects

Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei .... See Entry 65203

23.40 BETA DECAY; ELECTRON AND MUON CAPTURE

65238 **The decay of ^{100}Ag.** S.Rastikerdar, C.Garrett, G.S.Foote, W.Gelletly (Schuster Lab., Univ. of Manchester, Manchester, England).
J. Phys. G (GB), vol.9, no.5, p.555-72 (May 1983).
The gamma rays emitted in the decay of sources of ^{100}Ag produced in the ^{102}Pd(p,3n) and ^{92}Mo(^{12}C,p3n) reactions have been studied in singles and coincidence. Comparison of the measured relative intensities of gamma rays from sources produced in the two reactions confirms the existence of two beta-decaying isomers in ^{100}Ag with spins and parities 5^+ and $3^{(+)}$. Decay schemes for the two isomers were constructed on the basis of gamma-gamma coincidences. The half-life of ^{100}Ag was found to be 2.06 ± 0.25 min and no difference was found in the half-lives of the two isomers. The decay energy was determined to be 7.17 ± 0.25 MeV from studies of positron-gamma-ray coincidences. Measurements of log *ft* values and gamma-gamma angular correlations allowed the assignment of spins and parities to levels in ^{100}Pb. (32 refs.)

65239 **The beta decay of ^{137}Cs.** H.Behrens (Fachinformationszentrum Energie, Phys., Math., Karlsruhe, Germany), P.Christmas.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.131-40 (9 May 1983).
Evidence is presented to support the view that the approximate shape factor $C=q^2+bp^2$ does not adequately describe the second-forbidden beta decay of ^{137}Cs. An improved formula is given, with single-particle estimates of the nuclear matrix-element ratios. According to this model the coefficient of p^2 involves considerable cancellation between matrix elements; when due allowance is made for this, good fits to the experimental data are obtained, leading to better estimates of the decay scheme parameters. (22 refs.)

65240 **Decay studies of neutron-rich products from ^{76}Ge induced multinucleon transfer reactions including the new isotopes ^{62}Mn, ^{63}Fe and ^{71,72,73}Cu.** E.Runte, W.-D.Schmidt-Ott, P.Tidemand-Petersson (Phys. Inst., Univ. Gottingen, Gottingen, Germany), R.Kirchner, O.Klepper, W.Kurcewicz, E.Roeckl, N.Kaffrell, P.Peuser, K.Rykaczewski, M.Bernas, P.Dessagne, M.Langevin.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.163-80 (9 May 1983).
By irradiating a ^{nat}W target with 9 MeV/u ^{76}Ge ions, neutron-rich isotopes in the chromium-germanium region were produced. On-line mass-separated samples were investigated. The new isotopes ^{62}Mn, ^{71}Cu, ^{72}Cu and ^{73}Cu were identified and their half-lives measured as 0.88(15), 19.5(16), 6.6(1) and 3.9(3) s, respectively. The half-life of ^{63}Fe, a nucleus which has previously been detected using particle-identification techniques, was measured as 4.9(5) s. Decay schemes were derived in most cases. Additional spectroscopic information was obtained on the decays of ^{73}Zn and ^{74}Zn the authors give evidence that the earlier reported γ-ray activity attributed to ^{67}Ni belongs to the decay of the ^{70}Cu isomers. At $A=67$ we observed a new β-ray activity of 21(1) s half-life which is here assigned to the decay of ^{67}Ni. (29 refs.)

Neutrinoless double beta decay in the case of Dirac neutrinos .... See Entry 65084

Half-life measurements of excited levels in ^{157,159,161}Er .... See Entry 65237

The use of Ge detectors for precision positron-endpoint measurements of short lived nuclei .... See Entry 65825

23.60 ALPHA DECAY

On the Pauli exchange mechanism in the interaction of composite nuclei .... See Entry 65245

23.90 OTHER TOPICS IN NUCLEAR DECAY AND RADIOACTIVITY

Graphical representation of transmutation and decay chain data, transmutation cross section and delayed gamma ray emission data .... See Entry 65679

24.00 NUCLEAR REACTIONS AND SCATTERING: GENERAL

24.10 NUCLEAR REACTION AND SCATTERING MODELS AND METHODS

65241 **Comparison of the semiclassical coupled channel theory of particle transfer with exact calculations.** H.Esbensen, R.A.Broglia, A.Winther (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Ann. Phys. (USA), vol.146, no.1, p.149-73 (March 1983).
Making use of numerical techniques recently developed, inelastic and transfer processes associated with the collision of two systems have been exactly solved in a one-dimensional model. Comparisons are carried out with a coupled channel treatment and perturbation theory. The results are used to estimate the validity of the different approximations for the case of collisions between heavy ions. (11 refs.)

65242 **Relation between scattering lengths and effective radii in the charged and neutral channels.** V.S.Popov, A.E.Kudryavtsev, V.I.Lisin, V.D.Mur (Inst. of Theoretical & Experimental Phys., Moscow, USSR).
JETP Lett. (USA), vol.36, no.6, p.257-60 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR),* vol.36, no.6, p.207-10 (20 Sept. 1982). [received: April 1983]
The Coulomb correction to the strong scattering length $a_l^{(s)}$ and the effective radius $r_l^{(s)}$ are calculated for states with arbitrary angular momentum l. This allows relating the position and width near threshold resonances in charged and neutral channels for the lightest nuclei (^{5}He and ^{5}Li, etc.). The Coulomb correction to $a_l^{(s)}$ is especially large for the s wave, while the correction to $r_l^{(s)}$ is large for the p wave, when they contain the large logarithm $\ln(a_B/r_0)$, where a_B is the Bohr radius and r_0 is the range of nuclear forces. (9 refs.)

65243 **An investigation of ^{86}Sr wave functions with the (p,α) reaction at $E_p=35$ MeV.** P.Schober, H.H.Mueller (Physikinst., Univ. Zurich, Zurich, Switzerland), W.Pfeifer, H.Jasicek.
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.203-20 (25 April 1983).
Wave functions of low-lying states in ^{86}Sr have been calculated in a model space including $1g_{9/2}$, $2p_{1/2}$, $2p_{3/2}$ sub-shells but neglecting the proton-neutron residual interaction. These wave functions have been tested by the ^{89}Y(p,α)^{86}Sr reaction at $E=35$ MeV by applying a DWBA analysis with microscopic form factors. (34 refs.)

65244 **An effective interaction for inelastic scattering derived from the Paris potential.** N.Anantaraman, H.Toki, G.F.Bertsch (Nat. Superconducting Cyclotron Lab., Michigan State Univ., East Lansing, MI, USA).
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.269-78 (25 April 1983).
An effective interaction for inelastic scattering of nucleons from nuclei is derived by fitting oscillator *G*-matrix elements of the Paris nucleon-nucleon potential to the matrix elements of a sum of Yukawa terms. Except for the singlet-odd channel, these *G*-matrix elements do not differ in any significant respect from those obtained from the Reid soft-core potential, and give similar results for inelastic proton scattering. (19 refs.)

65245 **On the Pauli exchange mechanism in the interaction of composite nuclei.** G.Ciangaru (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.343-70 (25 April 1983).
The resonating group method kernel operators of composite nuclei interactions are investigated within a geometrical framework which relates the coordinates of the Pauli exchanged nucleons with the relative distance of nuclear fragments. Nucleon exchange density matrices, which contain detailed information about the Pauli exchange mechanism, are introduced to cast the kernel expressions in compact forms. A practical approach for calculating exchange kernels is given for certain applications in nuclear scattering and α-decay. (25 refs.)

65246 **A DWBA formalism for knockout-exchange reactions of composite nuclei.** G.Ciangaru (Dept. of Phys. & Astron., Univ. of Maryland, College Park, MD, USA).
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.371-96 (25 April 1983).
A DWBA formulation of the knockout-exchange scattering of composite projectiles having zero internal orbital angular momentum is presented. The model problem assumes a target nucleus heavy enough to allow the neglect of its recoil. The formalism accommodates any form of nucleon-nucleon potential containing central, tensor and spin-orbit terms which are treated on the same footing, with no multipole expansions. The nonlocal radial integrals assume transition nucleon exchange density matrices characteristic of finite potential well shell-model target and cluster model projectile wave functions. The usefulness of the formalism is demonstrated with a PWBA numerical application to the ^{26}Mg(^{6}Li,^{6}He)^{26}Al reaction. (28 refs.)

65247 **Collective coordinates as open systems. II. Time-scale for pure-state propagation.** E.S.Hernandez, C.O.Dorso (Dept. de Fisica, Univ. de Buenos Aires, Buenos Aires, Argentina).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.181-9 (9 May 1983).
In the frame of a general master equation, the authors investigate the condition for the propagation of pure-state wave packets conditioned to the gain-loss competition between the different components. If a perturbative approach is adopted, it is shown that the Hamiltonian type of evolution is destroyed within the microscopic time-scale, thus inhibiting the possibility of simulating the motion via a frictional Schrodinger equation as frequently undertaken. (8 refs.)

Partial wave analysis of $pp\rightarrow\pi d$, πd elastic and pp elastic in the dibaryon region .... See Entry 65163

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

Accurate determination of the ^{17}O-^{16}O+n coupling constant and spectroscopic factor .... See Entry 65205

D-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems .... See Entry 65209

(^{6}Li,d) reactions on ^{24}Mg and ^{26}Mg at 73 MeV .... See Entry 65211

Deformation effect in the fast neutron total cross section of aligned ^{59}Co .... See Entry 65249

Photonuclear reactions at intermediate energies .... See Entry 65254

Coherent (γ,γ) reactions in the resonance region .... See Entry 65255

Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei .... See Entry 65262

Alpha-cluster break-up and reaction mechanism in (p,α) reactions on light nuclei .... See Entry 65263

The ^{249}Bk(p,t)^{247}Bk reaction .... See Entry 65264

Cross-section measurement and Lane model analysis for the ^{9}Be(p,n)^{9}B reaction .... See Entry 65266

Inelastic scattering of ^{16}O from ^{60}Ni at 114 MeV .... See Entry 65272

The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg ... See Entry 65273

Extraction of the preformation probability of an α-cluster at the surface of heavy nuclei by means of α-transfer reactions leading to the continuum states .... See Entry 65275

Semiclassical calculations of ^{16}O-^{16}O elastic scattering cross-sections .... See Entry 65277

The deep inelastic yield at backward angles from ^{28}Si+^{12}C ... See Entry 65278

A macroscopic model for low energy heavy ion collisions .... See Entry 65279

Quasi linear response theory: analysis of the friction tensor and the energy transport .... See Entry 65280

Energy dependence of the friction coefficients .... See Entry 65281

Transfer induced energy dissipation in quasielastic collisions .. See Entry 65282

Effects of Pauli blocking and the local Fermi momentum in HI transfer reactions .... See Entry 65284

Alternative analysis of heavy-ion collisions involving nucleon transfer .... See Entry 65285

Systematics of linear momentum transfer in nucleus-nucleus collisions .... See Entry 65287

The measurement of light particle emission from ^{12}C+^{159}Tb, Ag and ^{89}Y reactions .... See Entry 65302

24.10H Optical and diffraction models

A folded diagram method for deriving an energy-independent nucleon-nucleon potential from meson exchange. I. Theory .... See Entry 65216

Correlated basis theory of nucleon optical potential in nuclear matter .... See Entry 65226

Deformation effect in the fast neutron total cross section of aligned ^{59}Co .... See Entry 65249

Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei .... See Entry 65262

Reaction ^{48}Ca (p,n) ^{48}Sc from $E_p=1.885$ to 5.1 MeV .... See Entry 65267

The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg ... See Entry 65273

24.30 RESONANCE REACTIONS AND SCATTERING

65248 Nuclear properties in the lead region within the quasiparticle-phonon nuclear model. V.G.Soloviev, C.Stoyanov, V.V.Voronov (Lab. of Theoretical Phys., JINR, Dubna, USSR).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.141-62 (9 May 1983).
The properties of the low-lying states and giant resonances in ^{208}Pb are calculated within the quasiparticle-phonon nuclear model, the model parameters being fixed. The fragmentation of the deep hole states $1h_{11/2}$, $1g_{7/2}$ and $1g_{9/2}$ in ^{207}Pb and $1g_{7/2}$, $1g_{9/2}$, $2p_{1/2}$ and $2p_{3/2}$ in ^{203,205,207}Tl is calculated, and qualitative agreement with the available experimental data is obtained. The s-, p- and d-wave neutron strength functions are calculated for ^{206}Pb+n and ^{207}Pb+n resonances. Their energy dependence is correctly described up to 0.9 MeV above the neutron binding energy B_n. The reduced E1 transition probabilities and the total photoabsorption cross sections $\sigma_{\gamma t}$ in ^{206,208}Pb are calculated. It is shown that substructures observed in the energy dependence $\sigma_{\gamma t}$ are caused by the fragmentation of one-phonon states. A fine structure of the isoscalar quadrupole resonance is explained, and the description of the LEOR and HEOR in ^{208}Pb is obtained, which is in agreement with the experimental data. (53 refs.)

Partial wave analysis of *pp*−⟩*πd*, *πd* elastic and *pp* elastic in the dibaryon region .... See Entry 65163

Recent data in p-p elastic scattering and diproton resonances .... See Entry 65168

Quenching of the mass operator associated with collective states in many-body systems .... See Entry 65200

^{9}Be+p elastic scattering at $2\leq E_p\leq 5$ MeV and levels in ^{10}B . See Entry 65214

Coherent (γ,γ) reactions in the resonance region .... See Entry 65255

Angular and energy dependence of the analyzing power A_{yo} of the reaction $p+p\rightarrow d+\pi^+$ between 725 and 1000 MeV .... See Entry 65258

Proton capture by ^{11}B above the giant resonance .... See Entry 65265

Reaction ^{48}Ca (p,n) ^{48}Sc from $E_p=1.885$ to 5.1 MeV .... See Entry 65267

Evaluation of neutron cross sections for vanadium .... See Entry 65268

Inelastic scattering of ^{16}O from ^{60}Ni at 114 MeV .... See Entry 65272

Evidence for dibaryon resonances from the measurement of the tensor polarization t_{20} in π^+-d scattering .... See Entry 65292

Dibaryon search in the pi-d system .... See Entry 65293

24.50 DIRECT REACTIONS

Excitation of continuum states in heavy-ion collisions .... See Entry 65235

A DWBA formalism for knockout-exchange reactions of composite nuclei .... See Entry 65246

Neutron multiplicity distributions and the role of transfer and breakup in quasielastic heavy-ion reactions at 15 MeV/nucleon .... See Entry 65274

Processes in competition in the reaction ^{14}N+^{12}C .... See Entry 65291

24.60 STATISTICAL THEORY AND FLUCTUATIONS

Nucleon momentum widths in ^{10}B from projectile fragmentation at 32 MeV/u .... See Entry 65217

Reaction ^{48}Ca (p,n) ^{48}Sc from $E_p=1.885$ to 5.1 MeV .... See Entry 65267

Alternative analysis of heavy-ion collisions involving nucleon transfer .... See Entry 65285

A kinetic flow analysis of streamer chamber data for Ne on NaF and Ar on Pb_3O_4 .... See Entry 65286

Angular momentum transfer and alignment following preequilibrium α-emission in heavy-ion reactions .... See Entry 65301

The onset of non-equilibrium phenomena in fusion-like processes for light heavy-ion systems .... See Entry 65303

24.70 POLARIZATION IN REACTIONS AND SCATTERING

65249 Deformation effect in the fast neutron total cross section of aligned ^{59}Co. U.Fasoli, G.Galeazzi, P.Pavan, D.Toniolo, G.Zago, R.Zannoni.
Report INFN/BE-82/2, Ist. Naz. Fis. Nucl., Padua, Italy (19 July 1982), 20 pp.
The variation of the total neutron cross section, $\Delta\sigma_{align}$, on ^{59}Co due to nuclear alignment of the target in the beam direction, has been measured over the energy range from 0.8 to 20 MeV, employing a cobalt single-crystal with a 34% nuclear alignment degree. The results show that $\Delta\sigma_{align}$ oscillates from a minimum of −5% at about 2.5 MeV to a maximum of +1% at about 10 MeV. The data were successfully fitted by optical model coupled-channel calculations. The coupling terms were deduced from a model representing the ^{59}Co nucleus as a vibrational ^{60}Ni core coupled to a proton-hole in a (1f 7/2) shell, without free parameters. The optical model parameters were determined by fitting the total cross-section independently measured. The theoretical calculations show that, at lower energies, $\Delta\sigma_{align}$ depends appreciably on the coupling with the low-lying levels. (40 refs.)

65250 Spin polarization in ^{20}Ne+^{168}Er collisions at 13.5 MeV/N. W.Dunnweber, W.Hering, R.Ritzka, W.Trautmann, W.Trombik, C.Egelhaaf, H.Homeyer (HMI fur Kernforschung, Berlin, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.97
In coincidence with light fragments from 270-MeV ^{20}Ne+^{168}Er, detected at 35°, the authors have measured the circular polarization P_γ of the γ-radiation along the scattering normal $K_i\times k_f$. From P_γ they deduce the relative contributions with negative and positive scattering angles to the differential cross section by taking into account the effects of non-aligned primary spin, of neutron evaporation and on non-stretched γ-decay. In the case of the deep-inelastic events they find that pure negative-(positive-) angle-scattering would correspond to $P_\gamma\approx+50\%$ (-50%). (no refs.)

p↿p↿ scattering at SIN .... See Entry 65165

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

Recent data in p-p elastic scattering and diproton resonances .... See Entry 65168

Nucleon-nucleon experiments at LAMPF .... See Entry 65169

Measurement of polarization parameters in pp elastic scattering and direct experimental reconstruction of the elastic scattering matrix at 445 MeV .... See Entry 65170

$d\sigma/d\Omega$ and a_y for small angle pp elastic scattering at 1.46 GeV/c .... See Entry 65171

K, π, p scatterings from polarized deuteron at KEK .... See Entry 65180

Excitation of continuum states in heavy-ion collisions .... See Entry 65235

The polarized beam asymmetry for $\gamma d\rightarrow Pn$ in the energy range 0.4-0.8 GeV .... See Entry 65252

An experimental test of charge symmetry in n-p elastic scattering .... See Entry 65257

Angular and energy dependence of the analyzing power A_{yo} of the reaction $p+p\rightarrow d+\pi^+$ between 725 and 1000 MeV .... See Entry 65258

Measurement of analyzing power in the $pp\rightarrow\pi^+d$ reaction ..... See Entry 65259

Cross-section measurement and Lane model analysis for the ^{9}Be(p,n)^{9}B reaction .... See Entry 65266

Tensor analyzing power in d-p elastic scattering at backward angles .... See Entry 65270

The relative contributions of positive and negative-angle scattering in ^{86}Kr-induced reactions .... See Entry 65290

Evidence for dibaryon resonances from the measurement of the tensor polarization t_{20} in π^+-d scattering .... See Entry 65292

Dibaryon search in the pi-d system .... See Entry 65293

24.90 OTHER TOPICS IN NUCLEAR REACTIONS AND SCATTERING, GENERAL

65251 Conclusions to be drawn from the workshop on future directions in electromagnetic nuclear physics. T.W.Donnelly (Dept. of Phys., MIT, Cambridge, MA, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.25-35 vol.1
The author summarizes some of the main conclusions to be drawn from the Workshop on Future Directions in Electromagnetic Nuclear Physics which began in the fall of 1979 and resulted in the Workshop report (commonly referred to as the 'Blue Book') in the spring of 1981. It is only possible in such a brief summary to be very general and, indeed, this talk might be regarded as one person's roadmap through the Blue Book, lacking any detail, but trying to identify the major features. In being so, it of course becomes a personal view of the highlights of the material in the report. (no refs.)

Lepton loss and entropy generation in stellar collapse .... See Entry 69633

25.00 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS

25.10 NUCLEAR REACTIONS AND SCATTERING INVOLVING FEW-NUCLEON SYSTEMS

p↿p↿ scattering at SIN .... See Entry 65165

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

Recent data in p-p elastic scattering and diproton resonances .... See Entry 65168

Nucleon-nucleon experiments at LAMPF .... See Entry 65169

$d\sigma/d\Omega$ and a_y for small angle pp elastic scattering at 1.46 GeV/c .... See Entry 65171

Angular and energy dependence of the analyzing power A_{yo} of the reaction $p+p\rightarrow d+\pi^+$ between 725 and 1000 MeV .... See Entry 65258

Measurement of analyzing power in the $pp\rightarrow\pi^+d$ reaction ..... See Entry 65259

Tensor analyzing power in d-p elastic scattering at backward angles .... See Entry 65270

25.20 PHOTONUCLEAR REACTIONS AND PHOTON SCATTERING

65252 The polarized beam asymmetry for $\gamma d\rightarrow Pn$ in the energy range 0.4-0.8 GeV. F.V.Adamyan, G.V.Arustamyan, P.I.Galumyan, V.H.Grabsky, H.H.Hakopyan, V.V.Karapetyan, H.A.Vartapetyan (Yerevan Phys. Inst., Yerevan, Armenian SSR).
AIP Conf. Proc. (USA), no.95, p.252-4 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Measurements of the polarized beam asymmetry for deuteron photodisintegration $\gamma d\rightarrow Pn$ have been carried out in the energy range $E_\gamma=0.4$-0.8 MeV and at angles $\theta_p^{cm}=45°$-75°. The results obtained are in disagreement with theoretical predictions which take into account the dibaryon resonance contribution. The data qualitative analysis indicates the weakness of isoscalar dibaryon amplitudes near $E_\gamma=400$ MeV. (8 refs.)

65253 Comment on the scaling behavior of Delbruck amplitudes. P.Rullhusen, U.Zurmuhl, F.Smend, M.Schumacher (II Phys. Inst., Univ. Gottingen, Gottingen, Germany), H.G.Borner, S.A.Kerr.
Phys. Rev. D (USA), vol.27, no.8, p.1962-4 (15 April 1983).
The authors compare the scaling behavior of Delbruck amplitudes recently predicted by Cheng, Tsai and Zhu (1982) with calculated lowest-order amplitudes and with empirical Coulomb-correction terms. The scaling behavior is confirmed for the lowest-order amplitudes at energies above 6 MeV and large scattering angles. The Coulomb-correction terms do not show the scaling behavior at least below energies of 10 MeV. (15 refs.)

65254 Photonuclear reactions at intermediate energies. J.H.Koch (Nat. Inst. for Nuclear & High Energy Phys., Amsterdam, Netherlands).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.226-36 vol.2
The Δ-hole approach provides a unified approach to study pion- and photon-induced nuclear reactions at intermediate energy. In this framework, it is shown that the many body modifications of Δ-h propagation, which were previously studied in pion scattering, also play an important role in photonuclear processes. Examples of this are shown for photoabsorption and coherent π^0 photoproduction. The detailed description of the Δ-h dynamics also allows one to decompose the total photoabsorption cross section into the major reaction channels. This makes it possible, for example, to compare directly to the measured charged hadron yield for photoabsorption on ^{4}He. (22 refs.)

65255 Coherent (γ,γ) reactions in the resonance region. E.Booth, J.Miller (Boston Univ., Boston, NY, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.237-48 vol.2
Elastic photon (Compton) scattering from complex nuclei is a fundamental reaction which is largely unexplored, especially above the pion threshold. At very forward angles, the amplitude is dominated by scattering from the Coulomb field of the nucleus (Delbruck scattering) and by atomic electrons (conventional electron Compton scattering). Beyond a few degrees, Delbruck scattering becomes negligible in the delta region, while photons scattered from electrons have energies of only a few MeV. The remaining nuclear Compton scattering between 200 and 500 MeV is dominated by the delta isobar, in the same way as pion scattering and photoproduction. Compton scattering in the delta-resonance region, along with pion scattering and neutral photoproduction, can be described in terms of the isobar-hole dynamics. (10 refs.)

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model .... See Entry 65248

Photonuclear research at the Bonn 500 MeV synchrotron ...... See Entry 65738

25.30 LEPTON-INDUCED REACTIONS AND SCATTERING

65256 Six-quark clusters by associated electro-production of K^+ and Σ^+ off nuclei. B.Povh, T.Walcher (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.219-25 vol.2
Associated K^+ and Σ^+ production off nuclei in deep inelastic electron scattering as a measure of the probability for finding six quark clusters in the nucleus is discussed. (7 refs.)

Accurate determination of the ^{17}O-^{16}O+n coupling constant and spectroscopic factor .... See Entry 65205

Magnetic form factor of ^{49}Ti at high momentum transfer .... See Entry 65210

25.40 NUCLEON-INDUCED REACTIONS AND SCATTERING

(see also 28.20 Neutron physics)

65257 An experimental test of charge symmetry in n-p elastic scattering. J.Birchall, N.E.Davison, H.P.Gubler, W.P.Lee, J.P.Svenne, W.T.H.van Oers (Dept. of Phys., Univ. of Manitoba, Winnipeg, Manitoba, Canada), E.B.Cairns, H.Coombes, C.A.Davis, P.Green, L.G.Greeniaus, W.J.McDonald, G.A.Moss, G.Roy, J.Soukup, G.M.Stinson, H.E.Conzett, G.R.Plattner.
AIP Conf. Proc. (USA), no.95, p.165-7 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
An experiment is described to investigate the isospin-mixing, charge-symmetry breaking component in the n-p interaction. The experiment measures the difference ΔA between the neutron and proton analyzing powers A_n and A_p in n-p elastic scattering at 500 MeV. The exeriment consists of two interleaved phases in which polarised neutrons, respectively unpolarized neutrons are scattered from an unpolarized, respectively polarized proton target of the frozen spin type. Designed as a null measurement requiring no accurately known polarization standards, the experiment determines the difference in angle at which A_n and A_p cross through zero. It is intended to provide an unambiguous test of class IV charge-symmetry breaking effects to the level of $_{G}A \simeq 0.001$, corresponding to a laboratory angle difference at zero crossing of $\sim 0.05°$. (6 refs.)

65258 Angular and energy dependence of the analyzing power A_{yo} of the reaction $p+p \rightarrow d+\pi^+$ between 725 and 1000 MeV. R.Bertini, P.Catillon, J.M.Cameron, H.Catz, J.M.Durand, G.P.Gervino, J.C.Lugol, B.Mayer (CENS, Guf-sur-Yvette, France), J.Arvieuz, S.Baker, L.Farvacque, C.Glashausser, D.A.Hutcheon, C.Whitten, G.Smith, A.Yavin.
AIP Conf. Proc. (USA), no.95, p.231-3 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The discovery of structure in spin-dependent cross sections for proton-proton scattering has been interpreted as evidence for dibaryon resonances. Resonance-like behaviour has been observed in several partial waves. The authors present results on the angular and energy dependence of differential cross sections ($d\sigma/d\Omega$) and vector analyzing power A_y of the $pp \rightarrow d\pi$ reaction between 725 and 1000 MeV, in steps of about 25 MeV, using the polarized proton beam of Saturne 2. Data were obtained by using the spectrometer SPES I to measure deuteron angle and momentum, which combined with time-of-flight information, clearly identified deuterons from $pp \rightarrow d\pi$, and permitted transformation of data to pion c.m. angle ($\theta_{cm}{}^{\pi}$). (6 refs.)

65259 Measurement of analyzing power in the $pp \rightarrow \pi^+d$ reaction. J.Hoftiezer, C.Weddigen (Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), S.Jaccard, P.Walden, P.Chatelain, B.Favier, F.Foroughi, J.Piffaretti.
AIP Conf. Proc. (USA), no.95, p.237-9 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The analyzing power, A_{yo}, of the reaction $pp \rightarrow \pi^+d$ has been measured to an accuracy of about 1% at 4 energies between 500 and 600 MeV at SIN. Pions and deuterons were detected in coincidence with scintillation detectors, using TOF techniques for event identification. Asymmetry results show considerable energy dependence in magnitude and shape. Final results have been fit, together with precise differential cross section data and muon detection. Numerical values of Legendre polynomial coefficients to describe A_{yo} and the differential cross section are presented. (2 refs.)

65260 On mean number of collisions in high energy hadron-nucleus interaction. J.Dolejsi, J.Formanek (Nuclear Centre, Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.389-400 (1983).
A mean number of collisions ν_{pA} in high energy proton-nucleus interactions is computed for different extrapolations of an elementary proton-nucleon amplitude. The power *A*-dependence parametrization of ν_{pA} is discussed in some detail. (14 refs.)

65261 Subthreshold K^+ production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei. N.K.Abrosimov, V.A.Volchenkov, V.A.Gordeev, V.A.Eliseev, E.M.Ivanov, V.P.Koptev, S.P.Kruglov, Yu.A.Malov, S.M.Mikirtych'yants, G.A.Ryabov, G.V.Shcherbakov (B.P. Konstantinov Inst. of Nuclear Phys., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.261-4 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.211-13 (20 Sept. 1982). [received: April 1983]
A new method is described for studying the 'subthreshold' production of K^+ mesons. The μ^+ mesons from the K^+ mesons stopped in the target are detected, and the microstructure of the proton beam is used. The total cross sections for K^+ production have been measured for the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei. (5 refs.)

65262 Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei. C.Lagrange, M.Girod (Service de Phys., Neutronique et Nucleaire, Centre d'Etudes de Bryeres-le-Chatel, Montrouge, France).
J. Phys. G (GB), vol.9, no.5, p.L97-102 (May 1983).
Semi-microscopic calculations of neutron elastic and inelastic scattering cross sections are calculated between 3.4 and 15 MeV by utilising the microscopic optical model of Jeukenne, Lejeune and Mahaux (1977) together with Hartree-Fock-Bogolyubov deformed nucleon density distributions. The coupled-channel formalism and the adiabatic rotational model are employed. With values for the range of the effective interaction previously determined for ^{208}Pb, the authors find that the theory gives a good description of neutron scattering from ^{238}U, ^{232}Th and ^{154}Sm. (21 refs.)

65263 Alpha-cluster break-up and reaction mechanism in (p,α) reactions on light nuclei. W.Buck, F.Hoyler, A.Stabler, G.Staudt (Phys. Inst., Univ. Tubingen, Tubingen, Germany), H.V.Klapdor, H.Oeschler.
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.189-202 (25 April 1983).
The differential cross sections for the $^{11}B(p,\alpha)^8Be$ and $^{23}Na(p,\alpha)^{20}Ne$ reactions were measured at bombarding energies between 6 and 24 MeV. The observed angular distributions can be divided into two domains: at low energies the shapes vary rapidly with incident energy indicating a compound nucleus reaction; at higher energies rather stable diffraction patterns are seen exhibiting a direct reaction mechanism and DWBA calculations are able to describe the shapes. The change from one region to the other is rather abrupt and this behaviour seems typical for reactions having an α-like compound nucleus. The energy at which this change occurs corresponds to an excitation energy in the compound nucleus of about 20 MeV above the α-threshold. (41 refs.)

65264 The $^{249}Bk(p,t)^{247}Bk$ reaction. R.A.Dewberry, R.T.Kouzes, R.A.Naumann (Joseph Henry Labs., Princeton Univ., Princeton, NJ, USA), R.G.Lanier, H.G.Borner, R.Hoff.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.1-10 (9 May 1983).
The $^{249}Bk(p,t)^{247}Bk$ reaction was performed with a 15 MeV proton beam from the Princeton University AVF cyclotron. The outgoing tritons were magnetically analyzed by a QDDD spectrometer. A DWBA analysis was performed, and a good $L=0$ angular distribution was observed populating the $^7/_2{}^+[633]$ bandhead in ^{247}Bk. Levels up to the $^{15}/_2$ member of this rotational band were populated at 41, 84, 137, 196 and 265 keV. No other peaks were observed. The absence of strength in the $^5/_2{}^+[642]$ band is shown to be consistent with the degree of mixing expected from calculation of the Coriolis interaction. The ground state of ^{249}Bk is discussed in terms of the gap in the neutron Nilsson levels at $N=152$. (24 refs.)

65265 Proton capture by ^{11}B above the giant resonance. M.Anghinolfi, P.Corvisiero, G.Ricco, M.Taiuti, A.Zucchiatti (Istituto di Sci. Fisiche, Univ. di Genova, Genova, Italy).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.66-82 (9 May 1983).
The cross sections for proton capture by ^{11}B to the ground and excited states of ^{12}C have been measured in the proton energy interval between 18 and 43 MeV. The ground-state cross section shows good agreement with theoretical calculations including correlations. Capture photons have also been observed to all the residual 1p-1h states of ^{12}C having a dominant $1p_{3/2}{}^{-1}$ hole: the corresponding cross sections systematically show a giant resonance whose energy increases with the increasing excitation energy of the 'background' level. The resonances at 27.4, 31, 33.2, 37 and 43 MeV, seem to show observable interference effects. (29 refs.)

65266 Cross-section measurement and Lane model analysis for the $^9Be(p,n)^9B$ reaction. R.C.Byrd, C.E.Floyd, P.P.Guss, K.Murphy, R.L.Walter (Dept. of Phys., Duke Univ., Durham, NC, USA).
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.94-118 (9 May 1983).
Neutron time-of-flight techniques were used to measure the $^9Be(p,n_0)^9B$ cross section from 0° to 160°(lab) at 10 energies between 8.15 and 15.68 MeV. The data are combined with previous results below 30 MeV in a Legendre coefficient analysis to evaluate the differential and integral behavior of the ^{9}Be(p,n) and $^9Be(p,n_0)^9B$ cross sections. A coupled-channels Lane analysis of cross sections and analyzing powers for (p,n) quasi-elastic scattering and (p,p) and (n,n) elastic scattering is presented and compared to previous single-channel models. (54 refs.)

65267 Reaction ^{48}Ca (*p,n*) ^{48}Sc from $E_p=1.885$ to 5.1 MeV. Gulzar Singh (Cyclotron Lab., Punjab Univ., Chandigarh, India), S.Kailas, S.Saini, A.Chatterjee, M.Balakrishnan, M.K.Mehta.
Pramana (India), vol.19, no.6, p.565-77 (Dec. 1982). [received: April 1983]
The total (*p, n*) reaction cross section for ^{48}Ca has been measured as a function of proton energy in the energy range 1.885 to 5.100 MeV with an overall resolution of ~2 keV and in ~5 keV energy steps. The fluctuations in fine resolution data have been analysed to determine the average coherence

width $\langle\Gamma\rangle$. The excitation function averaged over large energy intervals has been analysed in terms of the optical model. The isobaric analogue resonances at $E_p \sim 1.95$ and 4 MeV have been shape-analysed to extract the proton partial width and the spectroscopic factor S_n. A comparison of the gross structures observed in ~55 keV averaged excitation function with the predictions of Izumo's (1965) partial equilibrium model has also been made. (31 refs.)

65268 Evaluation of neutron cross sections for vanadium. S.Tanaka.
Report JAERI-M-82-151, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Oct. 1982), 41 pp.
Comprehensive neutron nuclear data for vanadium have been evaluated from thermal region to 20 MeV, and the results are to be filed in the ENDF/B format as an elemental component in Japanese Evaluated Nuclear Data Library-Version 2 (JENDL-2). The data base, the evaluation procedure and judgement, and the final results are described. The results include the neutron total cross sections, all significant partial cross sections of neutron induced reactions and the resonance parameters of vanadium. Particular attention has been payed to higher energy processes having an impact on the FBR and CTR. (46 refs.)

65269 Large transverse momentum transfer at 1 GeV proton disintegration of ^{238}U target. Yu.A.Chestnov, B.L.Gorshkov, A.I.Iljin, B.Yu.Sokolovski, G.E.Solyakin (Leningrad Nuclear Phys. Inst., Gatchina, USSR).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.90
Correlation kinematics measurements of complementary fragments are useful for understanding the interaction mechanisms of relativistic protons with heavy nuclei. Both masses and energies of complementary fragments were measured for ^{238}U target bombarded by a 1 GeV proton beam. The measurements were carried out for the fragments moving at the opposite direction perpendicular to the primary beam. The value $P_T = P_H - P_L = (2M_H E_H)^{1/2} - (2M_L E_L)^{1/2}$ was determined for every event, where subscripts H and L mean heavy and light fragments respectively. (1 ref.)

p↑p↑ scattering at SIN .... See Entry 65165

Proton-proton elastic amplitudes at several GeV .... See Entry 65167

Recent data in p-p elastic scattering and diproton resonances .... See Entry 65168

Nucleon-nucleon experiments at LAMPF .... See Entry 65169

Measurement of polarization parameters in pp elastic scattering and direct experimental reconstruction of the elastic scattering matrix at 445 MeV .... See Entry 65170

^{9}Be+p elastic scattering at $2 \leq E_p \leq 5$ MeV and levels in ^{10}B . See Entry 65214

The decay of ^{100}Ag .... See Entry 65238

An investigation of ^{86}Sr wave functions with the (p,α) reaction at $E_p = 35$ MeV .... See Entry 65243

An effective interaction for inelastic scattering derived from the Paris potential .... See Entry 65244

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model .... See Entry 65248

Deformation effect in the fast neutron total cross section of aligned ^{59}Co .... See Entry 65249

Average number $\bar{\nu}_p$ of prompt neutrons in the fission of ^{236}U nuclei by neutrons in the energy range 0.8-6 MeV .... See Entry 65298

Determination of the cumulative yields of short-lived products of thermal-neutron ^{239}Pu fission by means of the γ-spectrometric method under cyclic conditions .... See Entry 65299

25.50 ^{2}H- AND ^{3}H-INDUCED REACTIONS AND SCATTERING

65270 Tensor analyzing power in d-p elastic scattering at backward angles. J.Arvieux, S.D.Baker (Lab. Nat. Saturne, Gif-sur-Yvette, France), J.Banaigs, J.Berger, R.Beurtey, M.Boivin, A.Boudard, J.M.Cameron, A.Codino, J.Duflo, G.Gaillard, L.Goldzahl, D.A.Hutcheon, Nguyen-van-sen, C.F.Perdrisat, F.Plouin.
AIP Conf. Proc. (USA), no.95, p.228-30 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The tensor alignment T_{20} of 0.3 to 2.3 GeV polarized deuterons scattered by hydrogen has been measured at or near 180° CM angles, using the Saturne synchrotron. Large values are 0.5 GeV. The data are compared to various theoretical calculations including one-nucleon exchange with or without N components in the deuteron wave-function, a triangular graph with pion-exchange and rescattering mechanisms. (7 refs.)

25.60 ^{3}HE- AND ^{4}HE-INDUCED REACTIONS AND SCATTERING

65271 Channel cross correlations and intermediate structure in the ^{27}Al(d,α)^{25}Mg and ^{27}Al(d,p)^{28}Al reactions. S.C.Yeh, C.C.Hsu, J.C.Wang (Dept. of Phys., Nat. Tsing Hua Univ., Hsinchu, Taiwan), H.H.Lin, V.K.C.Cheng.
J. Phys. G (GB), vol.9, no.5, p.545-54 (May 1983).
The excitation functions of the protons and α particles for $\theta_{lab} = 90°$ and 160° from the reactions ^{27}Al(d,α)^{25}Mg and ^{27}Al(d,p)^{28}Al were measured in the range $E_d = 3.5$-6.2 MeV and analysed by the channel cross correlation function and autocorrelation function to determine the correlating number N_d and the average total level width $\langle\Gamma_\mu\rangle$, respectively. The energy-averaged angular distributions were fitted by the formula of Feshback (1960) to obtain the value of $\langle\Gamma_\mu\rangle/D$. With these quantities the theoretical intermediate width $\langle\Gamma_d\uparrow\rangle$ was calculated to be 206 keV, which is in good agreement with the experimental value 200±37 keV. In addition, the value of $n_d(n_d-1)/n^2$ was determined to be 0.30, which is quite close to the theoretical prediction $(2D/\pi\langle\Gamma_\mu\rangle)^{1/2} = 0.25 \pm 0.4$. (19 refs.)

Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei .... See Entry 65203

Nuclear Gamow-Teller strength in the Δ(3,3)-region .... See Entry 65234

Stellar reaction rate of ^{20}Ne(α,γ)^{24}Mg .... See Entry 69602

25.70 HEAVY ION INDUCED REACTIONS AND SCATTERING

65272 Inelastic scattering of ^{16}O from ^{60}Ni at 114 MeV. O.Hansen, P.D.Bond, S.Kubono, M.J.Levine, C.E.Thorn (Dept. of Phys., Brookhaven Nat. Lab., Upton, NY, USA).
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.325-42 (25 April 1983).
The ^{60}Ni(^{16}O,^{16}O′) reaction has been measured with about 100 keV energy resolution at a bombarding energy of 114 MeV. Twelve transitions to 2^+, 3^-, 4^+ and 5^- states were observed in the region below 5.8 MeV excitation and angular distributions of the corresponding differential cross sections were measured. DWBA and CC analyses are presented and spectroscopic information, in particular pertaining to the two-phonon strengths, is deduced. The deformation lengths $\beta_L R_2$ are compared to previous results from inelastic scattering with ^{4}He, ^{14}C and ^{16}O particles. Supplementary data in the region of the giant quadrupole resonance (GQR) were obtained, although the GQR was not identified. The experimental results are used in a discussion of the energy loss process in heavy ion collisions. (24 refs.)

65273 The ^{24}Mg(^{16}O,^{16}O′) reaction and triaxial structures in ^{24}Mg. J.Nurzynski, C.H.Atwood, T.R.Ophel, D.F.Hebbard (Dept. of Nuclear Phys., Australian Nat. Univ., Canberra, Australia), B.A.Robson, R.Smith.
Nucl. Phys. A (Netherlands), vol.A399, no.1, p.259-74 (9 May 1983).
Angular distributions for the elastic and inelastic scattering of ^{16}O from ^{24}Mg, exciting the 2_1^+ (1.37 MeV), 4_1^+ (4.12 MeV) and 2_2^+ (4.24 MeV) states, have been measured at $E_{c.m.} = 43.5$ MeV, an energy at which resonance-like structure has been observed previously in the related ^{24}Mg(^{16}O,^{12}C)^{28}Si reaction. In particular, the 4_1^+,2_2^+ doublet has been resolved for the first time for heavy-ion projectiles. The data have been well described by coupled-channels calculations within the framework of a Davydov-Filippov asymmetric rotor model for the low-lying states of ^{24}Mg, which has been extended to include a symmetric hexadecapole shape component. The optical model potential for the ^{16}O+^{24}Mg interaction was found to have a moderate real well depth and some surface transparency. The shape parameters for the nuclear potential were determined to be $\beta_2^{(N)} = 0.25$, $\gamma = 22°$ and $\beta_4^{(N)} = -0.065$ and the corresponding deformation lengths are in good agreement with earlier light-ion results. The inclusion of a negative symmetric hexadecapole component leads to an improved description of the reduced transition rates. The triaxial structure of ^{24}Mg is discussed. (42 refs.)

65274 Neutron multiplicity distributions and the role of transfer and breakup in quasielastic heavy-ion reactions at 15 MeV/nucleon. U.Jahnke, G.Ingold, H.Homeyer, M.Burgel, C.Egelhaaf, H.Fuchs, D.Hilscher (Hahn-Meitner-Inst. for Kernforschung Berlin, Berlin, Germany).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1246-9 (25 April 1983).
A new tool for the study of heavy-ion reactions is obtained by adapting a 4π-neutron-multiplicity counter to accelerator experiments. The instrument registers almost all neutrons emitted in each single reaction event. For quasielastic rections of 290-MeV ^{20}Ne+^{197}Au the measured neutron multiplicity distributions allow a quantitative decomposition of the cross section into two contributions: one with higher Q value from transfer reactions, one with lower Q value due to the decay of the projectilelike fragments. (14 refs.)

65275 Extraction of the preformation probability of an α-cluster at the surface of heavy nuclei by means of α-transfer reactions leading to the continuum states. Xu Shu-wei, Wu Guo-hua, Miao Rong-zhi, Han Fei (Inst. of Modern Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.95-100 (Jan. 1983). In Chinese.
The method of the parametrization of EFR-DWBA overlap integrals developed by T. Udagawa and T. Tamura et al. (1980), is improved. Using the improved method the present authors have fitted the experimental double differential energy spectrum of ^{8}Be-clusters coming from the reaction ^{208}Pb(^{12}C, ^{8}Be)^{212}Po leading to the continuum states and extracted the preformation probability of α-clusters at the surface of ^{212}Po nucleus. Within the range of calculation error, the result is in agreement with that extracted from fitting the experimental data of α-decay. (16 refs.)

65276 The subthreshold mechanism of the ^{6}Li+^{6}Li→3 α reaction at low energy. M.Lattuada, F.Riggi, C.Spitaleri, C.M.Sutera, D.Vinciguerra (Istituto di Fisica, Univ. di Catania, Catania, Italy).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.78
Many aspects of the nuclear reactions involving ^{6}Li have been interpreted by describing this nucleus in terms of an α-d cluster structure. This is the case for (p,pd) or (p,pα) quasi-free reactions, for (^{6}Li,d) and (^{6}Li,α) transfer reactions and for ^{6}Li break-up. Here, the authors discuss a subthreshold process in the ^{6}Li+^{6}Li→3α reaction, which can be only explained in terms of the α-d structure of ^{6}Li. The work of Norbeck et al. (1981) who measured the angular correlation between two α-particles at 2 MeV, shows that this reaction can be described by a quasi-free process in which one of the α-clusters (either in the projectile or in the target) is spectator of the ^{6}Li+d→2α virtual reaction, once the relative motion of the two ^{6}Li ions is brought to rest by the Coulomb repulsion. (3 refs.)

65277 Semiclassical calculations of ^{16}O-^{16}O elastic scattering cross-sections. P.C.Sood, C.Maheshwari (Banaras Hindu Univ., Varanasi, India), S.Mukherjee, R.K.Samanta.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.79
The authors use the generalized JWKB method to calculate the cross-sections for ^{16}O-^{16}O elastic scattering. The effect of inclusion of a realistic Coulomb potential is investigated in detail. They have calculated the phase shifts and the symmetrized cross-sections for the ^{16}O-^{16}O elastic scattering in the c.m. energy range 30-60 MeV. The nuclear potential parameters of Maher et al., (1969), are adopted. The phase shifts are calculated explicitly up to L=60 beyond which only Coulomb contribution is assumed. (4 refs.)

65278 The deep inelastic yield at backward angles from ^{28}Si+^{12}C. D.Shapira, K.A.Erb, J.L.C.Ford,Jr., R.Novotny, M.D.Schull, B.Shivakumar (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), S.T.Thornton, R.L.Parks, R.A.Cecil.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.80
Target-like reaction products from the bombardment of C targets by ^{28}Si beams have been studied at many bombarding energies in the range $99 \leq E_{Si} \leq 190$ MeV using the Brookhaven tandem accelerator. The reaction products were identified over a wide dynamic range of the outgoing fragment's kinetic energies using energy and energy loss information. Angular distributions were measured over the range of 2° to 30° (lab). The target-like

products observed at forward angles correspond (in the c.m. system) to the same products emitted at backward angles in a reversed reaction (target and projectile interchanged). The yield of these products is concentrated around a large negative O-value and the cross sections account for some 25% of the total non-fusion yield. Systematic studies of exit channel, bombarding energy, and observation angle dependence of these yields show essentially complete damping of the initial kinetic energy and imply the formation of a long-lived rotating dinuclear complex (orbiting) at an early stage of the collision. (1 ref.)

65279 **A macroscopic model for low energy heavy ion collisions.** G.F.Bertsch (Phys. & Astron. Dept., Michigan State Univ., East Lansing, MI, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.81
To have a better understanding of TDHF physics, there is a need for a simple model which mimics the TDHF dynamics. A suitable model would also permit one to make approximations to features of the dynamics that lie beyond the scope of TDHF. To this end the author proposes here a classical model in which only the most essential geometric variables are retained. Besides the relative coordinate of the centres-of-mass of the two nuclei, the author considers one additional geometric variable, the radius of a neck region connecting the two nuclei. The model is defined by considering the various sources of momentum transfer from one nucleus to another: namely, the Coulomb force, the nucleon flux between nuclei, and the nuclear force. These three forces can be simply parameterized in terms of the defined geometric variables. The relation between these variables is in turn parameterized according to the TDHF dynamics. The model gives reasonable deflection function and energy lossin collisions between very heavy nuclei, showing the deep inelastic scattering phenomenon. (3 refs.)

65280 **Quasi linear response theory: analysis of the friction tensor and the energy transport.** K.Niita, N.Takigawa (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.82
Reports on an analysis of the energy transport in deep inelastic heavy ion collisions by means of the quasi linear response theory, which extends the conventional linear response theory by consistently treating the relative motion and the intrinsic excitations based on a many body von Neumann equation and by taking into account higher order perturbation terms with respect to the coupling Hamiltonian between the relative and intrinsic motions in terms of Green's functions. Pb+Pb scattering is used as an example. (5 refs.)

65281 **Energy dependence of the friction coefficients.** E.N.El-Sayed (Dept. of Academic Studies, Arab Maritime Transport Acad., Alexandria, Egypt).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.83
The DIC and fusion experimental data are usually fitted with linear velocity dependent friction force. Nethertheless, some works suggest a non-linear velocity dependence of the nuclear friction. Starting from, this observation, the behaviour of the friction tensor (FC) as a function of energy can be studied by relating it to the imaginary potential. The radial- and energy dependence of the FC are given for ^{40}Ca-^{40}Ca head-on-collision case. (5 refs.)

65282 **Transfer induced energy dissipation in quasielastic collisions.** S.Pontoppidan (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.84
The mechanism of energy dissipation in heavy ion collisions have been investigated through a study of Q_{opt}-values obtained from 27 different reactions. The lightest system was $^{16}O+^{27}Al$ and the heaviest $^{56}Fe+^{122}Sn$. Each of these experiments allowed a complete Z and A identification of the reaction products. If only grazing angle spectra are considered one can with reasonable certainty identify the number of transferred nucleons as $\Delta M=|N'-N|+|Z'-Z|$, where (Z,N) and (Z',N') are the proton and neutron numbers for the projectile and the projectile-like reaction product, respectively. Q_{opt} is defined as the Q-value where the energy spectrum has its maximum. (6 refs.)

65283 **Angular distributions around O° of quasi elastic and deep inelastic reactions in light heavy ion collisions.** J.Payet, F.Pougheon, M.Bernas, P.Dessagne, D.Guillemaud, P.Roussel (Inst. de Phys. Nucleaire, Orsay, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.85
Due to obvious experimental difficulties, very few angular distributions are known at very forward angles and especially at 0°. These measurements however are important for nuclear spectroscopy and for the study of reaction mechanisms in heavy ions collisions. At Tandem energies, the suitable angular range will be between $\theta=0°$ and $\theta=5°$ lab. In this range the first lobe of the diffraction figure and the glory effects, if existing, can be observed. The authors report on results of a systematic study of the energy spectra and the very forward angular distributions $(-1°<0_{lab}<11°)$ of reaction products obtained by bombarding ^{12}C, ^{27}Al ^{26}Mg targets with ^{18}O 100 MeV beam from the Orsay MP Tandem. (1 ref.)

65284 **Effects of Pauli blocking and the local Fermi momentum in HI transfer reactions.** S.Pontoppidan (Niels Bohr Inst., Univ. of Copenhagen, Copenhagen, Denmark).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.86 (1 ref.)

65285 **Alternative analysis of heavy-ion collisions involving nucleon transfer.** S.Marsh (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.87
Excitation energy spectra are analyzed using a fermi gas prior distribution. The author finds that good fits to the data may also be obtained using a 'prior' distribution inspired by the exciton model: $P(E^*)=(E^*)^N \exp(-E^*/\Delta)$, where N and Δ are adjustable parameters. If taken literally, these two analyses would imply very different reaction processes: in the first, the reaction reaches a constrained equilibrium, whereas in the second the reaction appears to be multi-step direct. It is concluded therefore, that although the maximum entropy fits to the data are very good, this should not be taken as conclusive evidence for a particular reaction mechanism. (2 refs.)

65286 **A kinetic flow analysis of streamer chamber data for Ne on NaF and Ar on Pb_3O_4.** D.Keane, D.Beavis, S.Y.Fung, W.Gorn, A.Huie, J.J.Lu, R.T.Poe, B.C.Shen, G.VanDalen (Dept. of Phys., Univ. of California, Riverside, CA, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.89
In relativistic nucleus-nucleus collisions, the emergence of exclusive data from 4π detectors has motivated the development of 'global analyses' where the hydrodynamic or other possible collective behavior of nuclear matter in collisions can most effectively be studied. Recently, Gyulassy, Frankel and Stocker (1982) have proposed a kinetic flow analysis in which an event shape is associated with a kinetic flow tensor F, constructed from a set of measured final momenta in the c.m. frame: $F_{ij}=\Sigma_{\nu=1}{}^{N}\ P_i(\nu)\ P_j(\nu)/2m_\nu$ They also suggest a flow diagram in which the kinetic flow ratio f_1/f_3 (the ratio of the largest to smallest eigenvalue of F) is plotted against the polar angle of maximum kinetic flow. This analysis is used in the present study of two exclusive data samples: 1824 high multiplicity events corresponding to 425 MeV/A Ne on a 1.43 g/cm^2 NaF target, and 121 high multiplicity events corresponding to 400 MeV/A Ar on a 1.17 g/cm^2 Pb_3O_4 target. (2 refs.)

65287 **Systematics of linear momentum transfer in nucleus-nucleus collisions.** V.E.Viola,Jr., K.K.Kwiatkowski (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.91
The authors briefly summarize some of the salient systematic trends in the linear momentum transfer distributions derived from fission fragment angular correlation data at energies which extend well above the interaction barrier. At energies near the interaction barrier the fission fragment angular correlation data are characterized by two principal components: (1) a well-defined peak corresponding approximately to complete linear momentum transfer, or fusion-like reactions, σ_F, and (2) a broad distribution of events concentrated at momentum tranfer expected for peripherals reactions. Below 20-30 MeV/nucleon the linear momentum distributions for a variety of projectiles, ranging from protons to ^{20}Ne, can be parameterized consistently in terms of the projectile momentum and velocity or the average momentum transfer per nucleon. (4 refs.)

65288 **Light particle emission in projectile breakup process of heavy-ion reactions.** H.Utsunomiya, S.Kubono, M.H.Tanaka, M.Sugitani, K.Morita, T.Nomura, Y.Hamajima (Inst. for Nuclear Study, Univ. of Tokyo, Tanashi-shi, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.95
Reports on the magnitude and alignment of the transferred angular momenta associated with the projectile breakup process with the following capture property; i.e. after the breakup of projectle, a part of projectile is captured by a target nucleus. Importance of such mechanism for fast α-particle emission in heavy-ion reactions has recently been pointed out by several authors who often call the mechanism 'massive transfer' or 'breakup-fusion'. The authors have measured in-plane and out-of-plane angular correlations of fission fragments in coincidence with fast light particles emitted at 20° in the ^{232}Th(^{7}Li,xf) (x=p,d,t,α) reaction at 77 MeV. (3 refs.)

65289 **Angular momentum transfer in deep inelastic collisions: alignment and misalignment of fragment spin.** J.C.Steckmeyer, C.Le Brun, J.F.Lecolley, F.Lefebvres, M.L'Haridon, A.Osmont, J.P.Patry (Lab. de Phys. Corpusculaire, Univ. de Caen, Caen, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.96
Angular momentum transfer has been studied with sequential fission method in 255 MeV and 295 MeV Ar-Bi and 435 MeV Ni-Pb deep inelastic colisions. The sequential fission method allows one to measure both the aligned part and the in plane components of the heavy fragment spin and so to obtain informations about spin misalignment mechanisms occurring in the deep inelastic interaction. (4 refs.)

65290 **The relative contributions of positive and negative-angle scattering in ^{86}Kr-induced reactions.** J.de Boer, Ch.Schandera, Ch.Lauterbach, W.Dunnweber, W.Trautmann (Sektion Phys., Ludwig-Maximilians Univ., Munchen, Germany).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.98
The relative contribution to the cross section from trajectories with positive and negative sign of the scattering angle was determined for the $^{86}Kr+^{139}La$ and for the $^{86}Kr+^{166}Er$ reactions at incident energies of 705 MeV and of 860 MeV. For that purpose the circular polarization P_γ of γ-rays emitted in coincidence with the reaction products was measured as a function of the scattering angle θ_{lab} of the mass A, and of the Q-value of the ejectiles. (no refs.)

65291 **Processes in competition in the reaction $^{14}N+^{12}C$.** E.Bozek, Y.Cassagnou, R.Dayras, R.Legrain, A.Pagano, A.Palmeri, L.Rodriguez (DPh-NB/Be, CENS, Gif-sur-Yvette, France), G.Lanzano, G.Pappalardo.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.99
At energy slightly higher than the fusion barrier, the fusion process between light complex nuclei is limited by competition with direct reaction channels. In order to separate between the different competing mechanisms, the authors have undertaken a detail led study of the $^{14}N+^{12}C$ reaction at 62.7 MeV.s Light particles (p,d,t, ^{3}He and ^{4}He) were detected in coincidence with heavy fragments in a coplanar geometry. The heavy ion telescope was kept fixed at 10° relative to the beam directivity whereas three light-particle telescopes were moved on the other side of the beam to cover the angular range between 10° and 170°. (no refs.)

The mass of ^{18}N .... See Entry 65204

Accurate determination of the ^{17}O-$^{16}O+n$ coupling constant and spectroscopic factor .... See Entry 65205

(^{6}Li,d) reactions on ^{24}Mg and ^{26}Mg at 73 MeV .... See Entry 65211

Magnetic moments in the backbending region of ^{158}Dy .... See Entry 65213

Nucleon momentum widths in ^{10}B from projectile fragmentation at 32 MeV/u .... See Entry 65217

Formation and signature of quark matter in relativistic ion collisions: evidence from cosmic rays .... See Entry 65227

Excitation of continuum states in heavy-ion collisions .... See Entry 65235

The decay of ^{100}Ag .... See Entry 65238

Decay studies of neutron-rich products from ^{76}Ge induced multinucleon transfer reactions including the new isotopes ^{62}Mn, ^{63}Fe and ^{71,72,73}Cu .... See Entry 65240

On the Pauli exchange mechanism in the interaction of composite nuclei .... See Entry 65245

A DWBA formalism for knockout-exchange reactions of composite nuclei .... See Entry 65246

Spin polarization in ^{20}Ne+^{168}Er collisions at 13.5 MeV/N .... See Entry 65250

Fission barriers of Pb nuclei at high angular momentum .... See Entry 65296

Linear momentum transfer selectivity in ^{12}C induced reactions at intermediate energy (30-60 MeV/u) .... See Entry 65300

Angular momentum transfer and alignment following preequilibrium α-emission in heavy-ion reactions .... See Entry 65301

The measurement of light particle emission from ^{12}C+^{159}Tb, Ag and ^{89}Y reactions .... See Entry 65302

The onset of non-equilibrium phenomena in fusion-like processes for light heavy-ion systems .... See Entry 65303

Experiments with sub-nanosecond tandem beam pulses .... See Entry 65840

25.80 MESON- AND HYPERON-INDUCED REACTIONS AND SCATTERING

65292 Evidence for dibaryon resonances from the measurement of the tensor polarization t_{20} in π^+-d scattering. W.Gruebler, J.Ulbricht, V.Konig, P.A.Schmelzbach, A.Chisholm, K.Elsner, C.Schweizer, M.Merdzan (Lab. fur Kernphys., ETH, Zurich, Switzerland).
AIP Conf. Proc. (USA), no.95, p.234-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The tensor polarization t_{20} of π^+-d elastic scattering has been measured at 117 MeV, 134 MeV, 142 MeV and 151 MeV as a function of scattering angle. While at 134 MeV a strong and oscillatory behaviour prevails over the angular range measured (100-180°C c.m.), a considerable flattening of this structure is observed at 117 MeV and 151 MeV. This energy dependence and other observations are believed to manifest evidence for the presence of non-conventional dynamics in this energy region. (7 refs.)

65293 Dibaryon search in the pi-d system. E.L.Mathie (Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
AIP Conf. Proc. (USA), no.95, p.240-2 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Measurements of the polarization parameter, it11 in elastic pi-d scattering at a few specific angles with 140 and 256 MeV pion energy have been cited as evidence for the 1G4 dibaryon resonance. Two new experiments have been performed within the last year to expand this data set and clarify the situation. The first new experiment added data at 220, 275 and 294 MeV and confirmed three forward angle points at 256 MeV. The second new experiment employed a completely different data collection scheme with a multiple arm time-of-flight spectrometer. (6 refs.)

65294 Single neutron emission following the π^- absorption at rest in ^{12}C. C.Cernigoi, R.Cherubini, D.Gill, N.Grion, G.Pauli, R.Rui.
Report INFN/AE-82/13, Ist. Naz. Fis. Nucl., Trieste, Italy (6 Dec. 1982), 23 pp.
Presents the results of a measurement of the inclusive energy spectrum of the neutrons, as well as of that of the protons, emitted after the absorption of negative pions at rest in ^{12}C. The high energy tail of the neutron spectrum exhibits a peak corresponding kinematically to the single neutron emission process ^{12}C(π^-,n)^{11}B. The area under such peak gives an emission rate of 1.7×10^{-2} per stopped pion. (16 refs.)

Partial wave analysis of *pp*−⟩*πd*, *πd* elastic and *pp* elastic in the dibaryon region .... See Entry 65163

K, π, p scatterings from polarized deuteron at KEK .... See Entry 65180

On the transverse momentum of slow protons, deuterons, and pions in high energy interactions .... See Entry 65186

25.85 FISSION REACTIONS

65295 Fission of Bi induced by a quasi-monochromatic photon beam at energies from 100 MeV to 280 MeV. V.Bellini, V.Emma, S.Lo Nigro, C.Milone, G.S.Pappalardo (Istituto di Fisica, Univ. di Catania, Catania, Italy), E.De Sanctis, P.Di Giacomo, C.Guaraldo, V.Lucherini, E.Polli, A.R.Reolon.
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.587-92 (23 April 1983).
The photofision yields of Bi induced by the quasi-monochromatic photon beam from in-flight annihilation of positrons of the Frascati linac were measured. The experiment was performed at sixteen different positron energies, from 120 MeV up to 280 MeV, by collecting the annihilation photons at angles $0.5° < \theta < 1°$. Fission fragments were detected with glass sandwiches. Photofission cross-section values were deduced by means of an appropriate unfolding method. (15 refs.)

65296 Fission barriers of Pb nuclei at high angular momentum. D.J.Hinde, J.O.Newton, J.R.Leigh, R.J.Charity (Dept. of Nuclear Phys., Australian Nat. Univ., Canberra, Australia).
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.308-24 (25 April 1983).
Fission and evaporation residue excitation functions have been measured after the nuclei ^{192,195,198,200}Pb were formed by the fusion of ^{28,30}Si with ^{164,167,170}Er. The fission probabilities extracted were fitted using the rotating liquid drop/statistical model codes ORNL ALICE and MBII. The range of values of the mass asymmetry, $(N-Z)/A$, of the fissioning systems allows some restrictions to be placed on the value of the surface asymmetry parameter K, used in the liquid drop model, despite the many uncertainties and approximations in the data analysis. (28 refs.)

65297 Experimental fission barriers in heavy nuclei. D.Galeriu (Inst. de Fizica si Inginerie Nucleara, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.9, p.827-70 (1982). In Rumanian.
Discusses deformed compound nucleus states classification, double humped barrier penetrability, collective enhancement of level densities, fission barriers from isomeric fission, barrier property from neutron induced fission, fission following direct reactions, fission barriers for neutron deficient nuclei, and fission barrier systematics. (116 refs.)

65298 Average number $\bar{\nu}_p$ of prompt neutrons in the fission of ^{236}U nuclei by neutrons in the energy range 0.8-6 MeV. V.V.Malinovskii, V.G.Vorob'eva, B.D.Kuz'minov, V.M.Piksaikin, N.N.Semenova.
Sov. At. Energy (USA), vol.53, no.2, p.536-9 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.83-6 (Aug. 1982). [received: April 1983]
The average number $\bar{\nu}_p$ of prompt fission neutrons is one of the important characteristic parameters of nuclei undergoing fission. The present work deals with research on the energy dependence of $\bar{\nu}_p$ in the fission of ^{236}U by neutrons. (8 refs.)

65299 Determination of the cumulative yields of short-lived products of thermal-neutron ^{239}Pu fission by means of the γ-spectrometric method under cyclic conditions. A.G.Golovanov, A.N.Gudkov, V.V.Kazantsev, V.V.Kovalenko, A.B.Koldobskii, V.M.Kolobashkin, S.I.Lifanov, A.I.Slyusarenko.
Sov. At. Energy (USA), vol.53, no.2, p.576 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.117 (Aug. 1982). [received: April 1983]
Analysis of the experimental data on the yields of short-lived ($T_{1/2} < 50$ sec) fission products (FP) resulting from thermal-neutron ^{239}Pu fission shows their obvious inadequacy for solving practical problems and for checking the efficiency of the calculation methods used to predict the yield values not determined by experiment. The authors have measured the cumulative yields of a number of short-lived FP resulting from ^{239}Pu fission by the thermal neutrons described using the method of cyclic γ-spectrometric analysis of the radiation of unseparated FP mixtures. (8 refs.)

65300 Linear momentum transfer selectivity in ^{12}C induced reactions at intermediate energy (30-60 MeV/u). S.Song, M.F.Rivet, J.Galin, B.Borderie, R.Bimbot, I.Forest, D.Gardes, B.Gatty, D.Guerreau, M.Lefort, H.Oeschler, B.Tamain, X.Tarrago (Inst. de Phys. Nucleaire, Orsay, France).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.93
The linear momenta transferred by ^{12}C projectiles to heavy targets (Au,U) have been determined at 30 and 60 MeV/u. For the U target it is expected that the heavy target residues deexcite mainly through the fission channel. It is well known that the distribution of the linear momentum of the fission fragments. For C+Au only one peak is observed, corresponding to rather central collisions; the average value of P_{ij}/P_{proj} goes down from 2/3 to 1/2 when the energy is increased from 30 to 60 MeV/u. For C+U a drastic broadening of the momentum distribution is observed as the residues from peripheral collisions ($P \lesssim 1$ GeV/c) also undergo fission, due to their lower fission barrier. (3 refs.)

65301 Angular momentum transfer and alignment following preequilibrium α-emission in heavy-ion reactions. H.Utsunomiya, T.Nomura, S.Kohmoto, S.Sasagase (Inst. of Phys. & Chem. Res., Saitama, Japan).
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.94
The magnitude (I) and alignment (P_{zz}) of the transferred angular momentum are reported for preequilibrium α-particle emission in heavy-ion reactions. The present experiment was performed in order to investigate the projectile-dependence of I and P_{zz} in comparison with the authors' previous result (1981) obtained in ^{14}N-induced reaction. The authors have measured in-plane and out-of-plane angular correlations of fission fragments in coincidence with α-particles emitted in the reactions of ^{209}0Bi(^{20}Ne,αf) at 146 MeV. α particles were detected at 20° and 50° with respect to the beam direction. (2 refs.)

Systematics of linear momentum transfer in nucleus-nucleus collisions .... See Entry 65287

Light particle emission in projectile breakup process of heavy-ion reactions .... See Entry 65288

Angular momentum transfer in deep inelastic collisions: alignment and misalignment of fragment spin .... See Entry 65289

Experiments with sub-nanosecond tandem beam pulses .... See Entry 65840

25.88 FUSION REACTIONS

65302 The measurement of light particle emission from ^{12}C+^{159}Tb, Ag and ^{89}Y reactions. Dai Guang-xi, Jin Gen-ming, Yuan Shuang-qui, Guo Zhong-yan, Zeng Wen-bing, Chen Ju-sheng, Li Zu-yu, Wang Da-yan, Xu Guo-jun (Inst. of Modern Phys., Lanzhou, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.86-94 (Jan. 1983). In Chinese.
The energy spectra and angular distributions of α-particles emitted from ^{12}C-induced reactions with ^{159}Tb, Ag and ^{89}Y targets have been measured. Meanwhile the emitted deuteron's angular distributions with ^{159}Tb and ^{89}Y targets and proton's with ^{89}Y target have been also obtained. The α-energy spectra associated with the mentioned reactions have a bell-like shape with probable energy near coulomb barrier. However, the main characteristic of the α-angular distribution for ^{159}Tb and Ag targets is peaked at or near the grazing angles. For the case of ^{89}Y target, α-differential cross-sections monotonically decrease with angles beyond 40°. The angular distributions of protons and deuterons nearly decrease exponentially. In order to explain the anisotropic component of emitted α-particle, the authors propose incomplete fusion model with a strong-damped sticking rotation, in which the rotation angles and interaction time of the composite system are also estimated. (8 refs.)

65303 The onset of non-equilibrium phenomena in fusion-like processes for light heavy-ion systems. Y.Chan, M.Murphy, R.Stokstad, I.Tserruya, S.Wald (Lawrence Berkeley Lab., Berkeley, CA, USA), A.Budzanowski.
Proceedings of the International Conference on Nucleus-Nucleus Collisions (papers in summary form only received), East Lansing, MI, USA, 26 Sept.-1 Oct. 1982 (East Lansing, MI, USA: Michigan State Univ. 1982), p.100
The authors have measured the velocity distribution of evaporation residues produced in the reactions ^{16}O+Al, Ca and ^{60}Ni using oxygen beams of 8.8, 13.6 and 19.6 MeV/u from the LBL 88-Inch Cyclotron. The velocity, v, was obtained from the measured time of flight after corrections for energy losses in the target and start detector. Calibration of the absolute velocity scale was made by measuring the elastic scattering of 1.5 MeV/u ^{40}A ions from various targets. The centroid $\bar{v}$ of the reduced velocity spectrum, $N(v)/v^2$, was determined for each residue mass at each scattering angle θ by fitting a Gaussian function. The ratio $\bar{v}/V_{c.m.} \cos\theta$, where $eV_{c.m.}$ is the velocity of the center of mass, should equal unity provided there is complete momentum transfer and symmetry about 90° c.m. in the decay of the compound nucleus. They find that this ratio has little dependence on the residue mass and scattering angle. (2 refs.)

Processes in competition in the reaction ^{14}N+^{12}C .... See Entry 65291

Fission barriers of Pb nuclei at high angular momentum .... See Entry 65296

27.00 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES

27.10 A ≤ 5

Partial wave analysis of $pp \rightarrow \pi d$, πd elastic and pp elastic in the dibaryon region ..... See Entry 65163

p↑p↑ scattering at SIN ..... See Entry 65165

Proton-proton elastic amplitudes at several GeV ..... See Entry 65167

Measurement of polarization parameters in pp elastic scattering and direct experimental reconstruction of the elastic scattering matrix at 445 MeV ..... See Entry 65170

$d\sigma/d\Omega$ and a_y for small angle pp elastic scattering at 1.46 GeV/c ..... See Entry 65171

K, π, p scatterings from polarized deuteron at KEK ..... See Entry 65180

A study on the binding problem of Δ(1232) in nuclei with the Hartree-Fock method ..... See Entry 65206

D-wave asymptotic normalization constants for the ^{3}H and ^{3}He systems ..... See Entry 65209

The spectroscopy of a four-baryon system ..... See Entry 65229

The polarized beam asymmetry for $\gamma d \rightarrow Pn$ in the energy range 0.4-0.8 GeV ..... See Entry 65252

An experimental test of charge symmetry in n-p elastic scattering ..... See Entry 65257

Tensor analyzing power in d-p elastic scattering at backward angles ..... See Entry 65270

Evidence for dibaryon resonances from the measurement of the tensor polarization t_{20} in π^{+}-d scattering ..... See Entry 65292

Dibaryon search in the pi-d system ..... See Entry 65293

27.20 6 ≤ A ≤ 19

On the transverse momentum of slow protons, deuterons, and pions in high energy interactions ..... See Entry 65186

The mass of ^{18}N ..... See Entry 65204

Accurate determination of the ^{17}O-^{16}O+n coupling constant and spectroscopic factor ..... See Entry 65205

A study on the binding problem of Δ(1232) in nuclei with the Hartree-Fock method ..... See Entry 65206

^{9}Be+p elastic scattering at $2 \leq E_p \leq 5$ MeV and levels in ^{10}B . See Entry 65214

Nucleon momentum widths in ^{10}B from projectile fragmentation at 32 MeV/u ..... See Entry 65217

The $A=6$ isobaric triplet ..... See Entry 65224

Evidence for triton and alpha-particle clustering at high excitation in ^{15}N ..... See Entry 65225

Investigation of parity violation in ^{19}F ..... See Entry 65230

Nuclear Gamow-Teller strength in the Δ(3,3)-region ..... See Entry 65234

Subthreshold K^{+} production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei ..... See Entry 65261

Alpha-cluster break-up and reaction mechanism in (p,α) reactions on light nuclei ..... See Entry 65263

Proton capture by ^{11}B above the giant resonance ..... See Entry 65265

Cross-section measurement and Lane model analysis for the $^{9}Be(p,n)^{9}B$ reaction ..... See Entry 65266

The subthreshold mechanism of the $^{6}Li+^{6}Li \rightarrow 3\alpha$ reaction at low energy ..... See Entry 65276

Semiclassical calculations of ^{16}O-^{16}O elastic scattering cross-sections ..... See Entry 65277

The deep inelastic yield at backward angles from $^{28}Si+^{12}C$ ... See Entry 65278

Angular distributions around O° of quasi elastic and deep inelastic reactions in light heavy ion collisions ..... See Entry 65283

A kinetic flow analysis of streamer chamber data for Ne on NaF and Ar on Pb_3O_4 ..... See Entry 65286

Processes in competition in the reaction $^{14}N+^{12}C$ ..... See Entry 65291

Single neutron emission following the π^{-} absorption at rest in ^{12}C ..... See Entry 65294

Experiments with sub-nanosecond tandem beam pulses ..... See Entry 65840

27.30 20 ≤ A ≤ 38

(^{6}Li,d) reactions on ^{24}Mg and ^{26}Mg at 73 MeV ..... See Entry 65211

A DWBA formalism for knockout-exchange reactions of composite nuclei ..... See Entry 65246

Subthreshold K^{+} production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei ..... See Entry 65261

Alpha-cluster break-up and reaction mechanism in (p,α) reactions on light nuclei ..... See Entry 65263

Channel cross correlations and intermediate structure in the $^{27}Al(d,\alpha)^{25}Mg$ and $^{27}Al(d,p)^{28}Al$ reactions ..... See Entry 65271

The $^{24}Mg(^{16}O,^{16}O')$ reaction and triaxial structures in ^{24}Mg ... See Entry 65273

Angular distributions around O° of quasi elastic and deep inelastic reactions in light heavy ion collisions ..... See Entry 65283

A kinetic flow analysis of streamer chamber data for Ne on NaF and Ar on Pb_3O_4 ..... See Entry 65286

The onset of non-equilibrium phenomena in fusion-like processes for light heavy-ion systems ..... See Entry 65303

The use of Ge detectors for precision positron-endpoint measurements of short lived nuclei ..... See Entry 65825

Stellar reaction rate of $^{20}Ne(\alpha,\gamma)^{24}Mg$ ..... See Entry 69602

27.40 39 ≤ A ≤ 58

Magnetic form factor of ^{49}Ti at high momentum transfer ..... See Entry 65210

Excitation of continuum states in heavy-ion collisions ..... See Entry 65235

Reaction ^{48}Ca (p,n) ^{48}Sc from $E_p=1.885$ to 5.1 MeV ..... See Entry 65267

Evaluation of neutron cross sections for vanadium ..... See Entry 65268

Energy dependence of the friction coefficients ..... See Entry 65281

The onset of non-equilibrium phenomena in fusion-like processes for light heavy-ion systems ..... See Entry 65303

The use of Ge detectors for precision positron-endpoint measurements of short lived nuclei ..... See Entry 65825

Experiments with sub-nanosecond tandem beam pulses ..... See Entry 65840

27.50 59 ≤ A ≤ 89

Decay studies of neutron-rich products from ^{76}Ge induced multinucleon transfer reactions including the new isotopes ^{62}Mn, ^{63}Fe and $^{71,72,73}Cu$ ..... See Entry 65240

An investigation of ^{86}Sr wave functions with the (p,α) reaction at $E_p=35$ MeV ..... See Entry 65243

Deformation effect in the fast neutron total cross section of aligned ^{59}Co ..... See Entry 65249

Subthreshold K^{+} production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei ..... See Entry 65261

Inelastic scattering of ^{16}O from ^{60}Ni at 114 MeV ..... See Entry 65272

The measurement of light particle emission from $^{12}C+^{159}Tb$, Ag and ^{89}Y reactions ..... See Entry 65302

The onset of non-equilibrium phenomena in fusion-like processes for light heavy-ion systems ..... See Entry 65303

The use of Ge detectors for precision positron-endpoint measurements of short lived nuclei ..... See Entry 65825

27.60 90 ≤ A ≤ 149

Medium-spin levels in ^{137}Ce and the prolate-oblate shape transition in Ce nuclei ..... See Entry 65203

g-boson excitations in the interacting boson model ..... See Entry 65222

Measurement of B(E2)↑ values of the $5/2_2^{-}$ states of $^{107,109}Ag$ from the Coulomb excitation with protons ..... See Entry 65231

Search of the chemical change of the ^{119m}Sn ($T_{1/2}=293$ days) radioactive decay rate ..... See Entry 65236

The decay of ^{100}Ag ..... See Entry 65238

The beta decay of ^{137}Cs ..... See Entry 65239

Subthreshold K^{+} production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei ..... See Entry 65261

The relative contributions of positive and negative-angle scattering in ^{86}Kr-induced reactions ..... See Entry 65290

The measurement of light particle emission from $^{12}C+^{159}Tb$, Ag and ^{89}Y reactions ..... See Entry 65302

27.70 150 ≤ A ≤ 189

High-spin rotational bands and pairing reduction in ^{166}Hf ..... See Entry 65201

Magnetic moments in the backbending region of ^{158}Dy ..... See Entry 65213

Microscopic calculations in odd-odd nuclei ..... See Entry 65232

Half-life measurements of excited levels in $^{157,159,161}Er$ ..... See Entry 65237

Spin polarization in $^{20}Ne+^{168}Er$ collisions at 13.5 MeV/N .... See Entry 65250

Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei ..... See Entry 65262

The relative contributions of positive and negative-angle scattering in ^{86}Kr-induced reactions ..... See Entry 65290

Fission barriers of Pb nuclei at high angular momentum ..... See Entry 65296

The measurement of light particle emission from $^{12}C+^{159}Tb$, Ag and ^{89}Y reactions ..... See Entry 65302

27.80 190 ≤ A ≤ 219

Rotation-alignment effect in ^{198}Hg in an angular-momentum-projected band-mixing calculation ..... See Entry 65202

Nuclear magnetic moment of the 3.9 s $^{11}/_{2}^{-}$ isomer ^{193m}Au ... See Entry 65212

Mutual support of magicities and residual effective interactions near ^{208}Pb ..... See Entry 65219

Nuclear properties in the lead region within the quasiparticle-phonon nuclear model ..... See Entry 65248

Subthreshold K^{+} production in the interaction of 1-GeV protons with Be, C, Al, Cu, Sn, and Pb nuclei ..... See Entry 65261

Neutron multiplicity distributions and the role of transfer and breakup in quasielastic heavy-ion reactions at 15 MeV/nucleon ..... See Entry 65274

Extraction of the preformation probability of an α-cluster at the surface of heavy nuclei by means of α-transfer reactions leading to the continuum states ..... See Entry 65275

Quasi linear response theory: analysis of the friction tensor and the energy transport ..... See Entry 65280

A kinetic flow analysis of streamer chamber data for Ne on NaF and Ar on Pb_3O_4 ..... See Entry 65286

Angular momentum transfer in deep inelastic collisions: alignment and misalignment of fragment spin ..... See Entry 65289

Fission of Bi induced by a quasi-monochromatic photon beam at energies from 100 MeV to 280 MeV ..... See Entry 65295

Fission barriers of Pb nuclei at high angular momentum ..... See Entry 65296

Linear momentum transfer selectivity in ^{12}C induced reactions at intermediate energy (30-60 MeV/u) ..... See Entry 65300

Angular momentum transfer and alignment following preequilibrium α-emission in heavy-ion reactions ..... See Entry 65301

27.90 220 ≤ A

Semi-microscopic calculations of inelastic neutron scattering from heavy deformed nuclei ....See Entry 65262

The ^{249}Bk(p,t)^{247}Bk reaction ....See Entry 65264

Large transverse momentum transfer at 1 GeV proton disintegration of ^{238}U target ....See Entry 65269

Light particle emission in projectile breakup process of heavy-ion reactions ....See Entry 65288

Average number $\bar{\nu}_p$ of prompt neutrons in the fission of ^{236}U nuclei by neutrons in the energy range 0.8-6 MeV ....See Entry 65298

Determination of the cumulative yields of short-lived products of thermal-neutron ^{239}Pu fission by means of the γ-spectrometric method under cyclic conditions ....See Entry 65299

Linear momentum transfer selectivity in ^{12}C induced reactions at intermediate energy (30-60 MeV/u) ....See Entry 65300

28.00 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

(see also 86.10 Energy resources and their utilisation)

28.20 NEUTRON PHYSICS

(see also 25.40 Nucleon-induced reactions and scattering)

65304 A finite element method for neutron transport. VII. Completely boundary-free maximum principle for the first-order Boltzmann equation. R.T.Ackroyd (Northern Div., UKAEA, Risley, Warrington, England).
Ann. Nucl. Energy (GB), vol.10, no.5, p.243-61 (1983).
For pt.VI see ibid., vol.9, p.315 (1982). A completely boundary-free maximum principle for the first-order Boltzmann equation is derived from the completely boundary-free maximum principle for the mixed-parity Boltzmann equation. When continuity is imposed on the trial function for directions crossing interfaces the completely boundary-free-principle for the first-order Boltzmann equation reduces to a maximum principle previously established directly from first principles and indirectly by the Euler-Lagrange method. Present finite element methods for the first-order Boltzmann equation are based on a weighted-residual which permits the use of discontinuous trial functions. The new principle for the first-order equation can be used as a basis for finite-element methods with the same freedom boundary conditions as those based on the weighted-residual method. The extremum principle as the parent of the variationally-derived weighted-residual equations ensures their good behaviour. (12 refs.)

65305 Stability analysis of the neutron transport equation with temperature feedback. C.V.Pao (Dept. of Math., North Carolina State Univ., Raleigh, NC, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1321-5 (May 1983).
The author discusses the stability and instability of neutron transport in a reactor system where positive temperature feedback is taken into consideration. The feedback effect is considered only through the multiplication factor in the neutron transport equation. This consideration leads to a coupled system of nonlinear partial integrodifferential equations of neutron transport and heat conduction. The investigation of this coupled nonlinear initial boundary-value problem is based on the existence-comparison theorem established in an earlier paper in which an iterative scheme for the determination of the solution is given. It is shown that by constructing a suitable pair of the comparison functions, called upper and lower solutions, as two distinct initial iterations, the corresponding sequences converge monotonically from above and below, respectively, to a unique solution of the system. Under certain conditions on the multiplication factor, the property of upper and lower solutions determines the asymptotic behavior of the solution and leads to stability or instability of the system. A stability region for the zero steady state and an instability region of the system are also given. (7 refs.)

65306 Leakage of the gas of ultracold neutrons from a trap. A.V.Antonov, B.I.Goryachev, A.I.Isakov, N.V.Lin'kova.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.36-41 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.41-7 (1982).
The Monte Carlo method is used to obtain the temporal distributions (leakage spectra) of monoenergetic ultracold neutrons leaking from a trap. Methods are considered for the approximation of the leakage spectra. (6 refs.)

Teaching neutron diffusion theory ....See Entry 64607

28.41 FISSION REACTOR THEORY AND DESIGN

65307 Density fluctuations in simple stochastic reactor models. M.A.Rodriguez (Dept. de Fisica Teorica, Univ. de Santander, Santander, Spain), M.San Miguel, J.M.Sancho.
Ann. Nucl. Energy (GB), vol.10, no.5, p.263-9 (1983).
The authors present a method to study density fluctuations in a nuclear reactor simultaneously taking into account intrinsic fluctuations usually modelled by a master equation and parametric noise usually modelled by stochastic kinetic equations. The mean density and density-fluctuations variance are calculated for a simple point-reactor model in the presence of Gaussian white-noise fluctuations in the fission, capture and source event rates. They are also calculated in the case of dichotomous noise fluctuations in the source event rate. They find 'crossed fluctuation' contributions to the density fluctuations that only appear when considering simultaneously intrinsic and parametric noise. These contributions allow one to distinguish between reactivity fluctuations due to fission-rate and capture-rate fluctuations. (18 refs.)

65308 Tight multilattices calculated by extended-cell cylindrization. M.Segev, S.Carmona (Dept. of Nuclear Engng., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Ann. Nucl. Energy (GB), vol.10, no.5, p.271-6 (1983).
Among the common features of advanced LWR concepts are the tightness of lattices and the symbiotic setting of different fuels. Such symbioses often come in the form of multilattices, whose numerically-repeated unit is a configuration of several pins, typically with one pin type at the center and pins of a second type surrounding the center pin. If this extended-cell (EC) unit is cylindricized, then a simple transport calculation of the unit will be possible. If the lattice of such units is tight, there is further an a priori reason to expect the cylindrization to introduce only a small distortion of the true neutron fluxes in the lattice. A strict numerical validation of the EC cylindrization approximation is impractical, but similar validations can be carried out for regular lattices, viewed as being made up of multicell units whose centers are moderators and whose peripheries are fuel pins. In these comparisons the EC cylindrization approximation gives good results. (6 refs.)

65309 Exact solutions of two point time correlations on point reactor kinetics with Gaussian reactivity fluctuations. M.A.Rodriguez, L.Pesquera (Dept. de Fisica Teorica, Univ. de Santander, Santander, Spain).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.174-6 (Feb. 1983).
The authors extend the exact solution for the mean stationary value of a point reactor with Gaussian reactivity fluctuations derived by Saito (1980), to variances and two point time correlations. They study these functions for all possible values of the Gaussian noise correlation time. (8 refs.)

65310 Suboptimal control of large scale linear quadratic problems using time-scale decomposition. H.Kando (Center of Information Processing Education, Nagoya Inst. of Technol., Nagoya, Japan).
Large Scale Syst.-Theory & Appl. (Netherlands), vol.4, no.1, p.1-25 (Feb. 1983).
Using time-scale decomposition techniques, the design procedure for large scale dynamical systems with quadratic cost is presented. First, the fixed endpoint problem is studied, and secondly, and free endpoint problem is investigated. Furthermore, performance degradation of a suboptimally controlled system is examined. Finally, in order to illustrate this method, the numerical example applied to a nuclear reactor control problem is given. (56 refs.)

65311 Numerical treatment of the cladding mechanics in the fuel rod computer code IAMBUS. G.West (INTERATOM, Gladbach, Germany).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.25-9 (Jan. 1983).
IAMBUS (*I*NTER*A*TOM *M*odel for *B*urn-*U*p *S*tudies on fuel Rods) is a digital computer code for the thermal and mechanical design, in-pile performance prediction and post-irradiation analysis of fuel rods. The mechanical analysis of the cladding is approximated by a state of generalized plane strain. The analysis includes routines for plasticity, creep and swelling due to void nucleation and growth. The numerical integration of these equations is described in detail and the accuracy of the results is discussed. (2 refs.)

65312 A review of flow-induced vibrations in reactors and reactor components. M.P.Paidoussis (Dept. of Mech. Engng., McGill Univ., Montreal, Quebec, Canada).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.31-60 (Jan. 1983).
The author presents a review of two classes of vibration problems encountered in reactors and reactor peripherals: namely, vibration of cylindrical structures induced by cross flow and by axial flow. A historical perspective is given in which the milestone contributions that have advanced the state of the art are highlighted. Recent developments in the last three years are discussed, concluding with an assessment of the fluidelastic mechanisms involved, and the predictive tools available. (240 refs.)

65313 Dynamic response of a SDOF elastic-plastic system subjected to aircraft impact pulses. G.Meder (Brown, Boveri & Cie, AG, Mannheim, Germany).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.61-74 (Jan. 1983).
The author studies the responses of elastic-plastic systems subjected to aircraft impact pulses. The results are compared with simpler pulse models and represented in the useful form of design charts. Two well-known approaches to seismic spectra are examined for the design of aircraft impact spectra. (9 refs.)

65314 Curve fitting to defect size distributions for the calculation of failure probabilities. A.Bruckner (Kernforschungszentrum, Arbeitsgruppe Zwerlassigkeit und Schadenskunde im Maschinenbau, Inst. fur Reaktorbauelemente, Karlsruhe, Germany), D.Munz.
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.75-8 (Jan. 1983).
The imperfection size distribution of pipe welds reported by Raussi and Tiainen (1980) is analysed. A lognormal distribution and a Weibull distribution are shown to be compatible with the data. (4 refs.)

65315 Laminar flow induced deflections of stacked plates. S.J.Pavone (General Electric Co., Schenectady, NY, USA), H.A.Scarton.
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.79-98 (Jan. 1983).
Some research and power reactors have core designs which consist of parallel, flat or curved plate fuel assemblies. The fuel is contained in the thin plates which are separated by narrow channels through which coolant flows. Since the plates are flexible, the coolant flowing through the channels causes the plates to deflect. At high coolant velocities large deflections have been observed causing the plates to deform plastically leading to structural failure or plate collapse. The authors examine a single plate bounded by two channels and determine the static plate deflection as a function of plate, channel and flow parameters. (14 refs.)

65316 Calculations of hydrogen detonations in nuclear containments by the random choice method. M.A.Delichatsios, M.B.Genadry.
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.117-26 (Jan. 1983).
Computer codes were developed for the prediction of pressure histories at different points of a nuclear containment wall due to postulated internal hydrogen detonations. These pressure histories are required to assess the structural response of a nuclear containment to hydrogen detonations. The compressible flow equations including detonation, which was treated as a sharp fluid discontinuity, were solved by the random choice method which reproduces maximum pressures and discontinuities sharply. The computer codes were validated by calculating pressure profiles and maximum wall pressures for plane and spherical geometries and comparing the results with exact solutions. The two-dimensional axisymmetric program was used to calculate wall pressure histories in an actual nuclear containment. The numerical results for wall pressures are presented in a dimensionless form, which allows their use for different combinations of hydrogen concentration, and initial conditions. (15 refs.)

65317 Comparison analysis of the reliability and efficiency of nuclear power station units with one and two turbogenerator sets. I.Ya.Emel'yanov, A.I.Klemin, Yu.I.Koryakin, V.S.Emel'yanov, N.A.Trekhova.
Sov. At. Energy (USA), vol.53, no.2, p.515-19 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.67-70 (Aug. 1982). [received: April 1983]
The authors compare the reliability and efficiency of nuclear power stations operating with either one or two turbogenerator units. They use a complex index equal to the ratio of the average output at failure to the average time of emergency repair. (12 refs.)

65318 Operating efficiency of steam separators in power plants with RBMK reactors. V.B.Karasev, Yu.M.Nikitin, O.Yu.Novosel'skii, E.V.Sakovich.
Sov. At. Energy (USA), vol.53, no.2, p.519-25 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.70-4 (Aug. 1982). [received: April 1983]
The drum steam separators in a multiple forced circulation circuit are analysed for their reliability and efficiency with RBMK reactors. (3 refs.)

65319 Quasilinear approximation in the statistical analysis of the simplest nonlinear dynamic model of a power reactor. Yu.V.Volkov, A.G.Kostromin, V.K.Nazarov.

Sov. At. Energy (USA), vol.53, no.2, p.555-8 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.103-5 (Aug. 1982). [received: April 1983]

In the statistical analysis of dynamic properties, and also in estimating the thermotechnical reliability of power reactors, it is necessary to know the probabilistic characteristics of their power. The basic characteristics are the one- and two-dimensional laws of power and reactivity distribution, and also the first two moments of these distributions. The authors present a complete statistical analysis of the simplest nonlinear dynamic model conducted in the quasilinear approximation for exponentially correlated fluctuations of the reactivity. (3 refs.)

65320 Problems in summarizing experimental data on the heat-transfer crisis in boiling. Yu.V.Mironov, S.V.Shpanskii.

Sov. At. Energy (USA), vol.53, no.2, p.567-9 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.110-11 (Aug. 1982). [received: April 1983]

The heat-transfer crisis is one of the main thermophysical factors that restrict increased specific power in nuclear-power systems. Therefore, there are many experimental studies on the crisis, and extensive experimental evidence has been accumulated. Much attention has recently been given to the physical essence of the process. This has provided a reasonably sound qualitative picture that indicates how the individual parameters influence the process. However, at present it is impossible to predict the crisis reliably on the basis of a detailed description of the hydrodynamics of the flow in a channel with fuel-rod elements. A decisive role in thermophysical calculations is assigned to semiempirical models and to correlations derived from statistical processing of the experimental data. The authors present some of the difficulties involved with processing the experimental data. (6 refs.)

65321 Temperature coefficients for global stability in a reactor with two-temperature feedback. R.S.Poddar, M.S.Trasi (Theoretical Reactor Phys. Section, Bhabha Atomic Res. Centre, Bombay, India).

Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.164-79 (March 1983).

The non-linear stability of a nuclear reactor system with two-temperature feedback has been analysed. Using Welton's criterion as well as Liapounov's second method, it has been shown that if the delayed temperature coefficient lies between certain limits of opposite signs, the system will be globally and asymptotically stable. It has also been proved that the region of global stability in the parametric plane of temperature coefficient of reactivity, obtained from Welton's criterion, curtains that obtained from Liapounov's second method with a Liapounov function used in this work. (12 refs.)

65322 Multivariable control in nuclear power stations: Order reduction. M.Parent, P.D.McMorran.

Report AECL-7245, Atomic Energy Canada Ltd., Chalk River, Ont. (Dec. 1982), v+34 pp.

Linear, state-space models of power plant systems tend to be of high order, leading to difficulties in the design of control systems by state-space methods. However, the control system has access only to the plant inputs and outputs, and the fast-responding internal variables may be masked by slower, dominant variables. Model order reduction applies modal analysis to eliminate the fast modes while retaining the character of the input-output response. Two alternative techniques are presented and demonstrated on a model of a nuclear steam generator. The preferred method is implemented in MVPACK, the computer-aided design package. (8 refs.)

65323 A simulator for the Superphenix 1 nuclear power plant. J.C.Bluet, C.Fourcade, J.C.Quinton (Cadarache, CEN, Saint-Paul-Lez-Durance, France).

10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.86-8 vol.4

The authors report on a simulator mainly devoted to training of operators working at the Superphenix plant, which is the industrial prototype of the French breeder program. After they recall the main features of the plant, they describe the various and specific aspects of this simulator: the physical-mathematical model, the training desk, and the data processing realization. (no refs.)

65324 Advanced safety code CATHARE summary of verification studies on 'separate effect' experiments. J.C.Rousseau, G.Houdayer (Service des Transferts Thermiques, CENG, Grenoble, France).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.343-51 vol.1

The CATHARE code is developed for the analysis of pressurized water reactor accidents. A one-dimensional two phase-two fluid model is used. The authors describe the constitutive laws introduced in this model, concerning interfacial momentum and mass transfers. All these correlations are issued from an analysis of 'separate effect' experiments belonging to the experimental CATHARE verification program. These experiments were specially developed to study all the flow regimes of importance for nuclear safety analysis. (21 refs.)

65325 TRAC-PF1 choked-flow model. M.S.Sahota, J.F.Lime (Los Alamos Nat. Lab., Los Alamos, NM, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.480-6 vol.1

The two-phase, two-component choked-flow model implemented in the latest version of the transient Reactor Analysis Code (TRAC-PF1) was developed from first principles using the characteristic analysis approach. The subcooled choked-flow model in TRAC-PF1 is a modified form of the Burnell model. The authors discuss these choked-flow models and their implementation in TRAC-PF1. Comparisons using the TRAC-PF1 choked-flow models are made with the Burnell model for subcooled flow and with the homogeneous-equilibrium model (HEM) for two-phase flow. These comparisons agree well under homogeneous conditions. Generally good agreements have been obtained between the TRAC-PF1 results from models using the choking criteria and those using a fine mesh (natural choking). Code-data comparisons between the separate-effects tests of the Marviken facility and the Edwards' blowdown experiment also are favorable. (10 refs.)

65326 The development of a nodal method for the stability analysis of ventilated boiling channels. R.Taleyarkhan, M.Podowski, R.T.Lahey,Jr. (Dept. of Nuclear Engng., Rensselaer Polytech. Inst., Troy, NY, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.487-97 vol.1

A mathematical model has been developed for the linear stability analyses of a system of ventilated parallel boiling channels. Various physical phenomena such as: phasic slip, nonuniform axial power distribution, distributed local losses, heater wall dynamics, radial power skews, turbulent mixing, and various donor-cell options, have been incorporated. The system of linearized, Laplace transformed nodal equations was integrated using an efficient numerical algorithm. A new matrix-reduction method, developed for this purpose is presented. (11 refs.)

65327 BODYFIT-2PE and its application to CHF prediction of GE 3×3 rod bundle. T.H.Chien, B.C.-J.Chen, W.T.Sha (Components Technol. Div., Argonne Nat. Lab., Argonne, IL, USA), J.H.Kim.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.498-507 vol.1

BODYFIT-2PE is a three-dimensional, steady-state/transient, single-phase/two-phase rod-bundle thermal-hydraulic computer program based on the technique of boundary-fitted coordinate system and partially elliptic approximation. It uses the homogeneous equilibrium model with algebraic slip to model the two-phase flow. Due to the use of the non-orthogonal coordinate system, a modified staggered-mesh arrangement is used where velocities are stored at intersections of grid lines and the enthalpy and pressure are stored at the center of the cells formed by the grid lines. The corresponding numerical method and the pressure correction scheme are presented. BODYFIT-2PE was used to calculate the critical heat flux of a GE 3×3 rod bundle. The calculations were compared with the experimental measurements in terms of average heat fluxes and boiling lengths at the occurrence of critical heat fluxes. (6 refs.)

65328 A method to determine transient critical power ratios for boiling water reactors. A.F.Ansari (Yankee Atomic Electric Co., Framingham, MA, USA), S.L.Forkner.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.508-18 vol.1

A method for the determination of fuel transient critical power ratios (CPRs) for boiling waaer reactors has been developed. This method is based on the RETRAN and TCP computer codes. The critical power ratio approach is used to describe the conditions at which a boiling transition from nucleate to film boiling occurs. Qualification of this method is provided through comparisons to transient boiling transition data. (5 refs.)

65329 Analysis of Westinghouse controlled transient heat transfer tests using the FAST code. H.A.Khater (Nuclear Products Dept., Westinghouse Canada Inc., Hamilton, Ontario, Canada), G.D.Raithby, M.Merilo.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.519-27 vol.1

FAST is a recently-developed numerical model for predicting one-dimensional, transient, thermal non-equilibrium two-phase flows, including the effect of heat conduction in the walls. The predictions of the FAST model are compared with measurements obtained from the Westinghouse J-Loop. In addition, the model has been used to predict the cross-sectional average flow conditions at the time and location of the first observed CHF, and the performance of several correlations used to predict CHF, including a new proposed one, are evaluated. (11 refs.)

65330 Reactor coolant model for a power plant operator's training simulator. P.Deshpande, P.Lu, K.Choung (Gould Simulation Systems Inc., Melville, NY, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.588-94 vol.1

The Reactor Coolant System (RCS) of Combustion Engineering System 80 Nuclear Power Plant for Washington Public Power Supply System Unit 3 is modeled for a real-time operator's training simulator using the SEL 32/77 computer. The RCS consists of a reactor vessel; two parallel heat transfer loops, each containing a U-tube steam generator and two reactor coolant pumps; and a pressurizer connecting to one of the reactor vessel outlet pipes. The pressurizer pressure and water level is calculated by considering the RCS, including the pressurizer, as a two-phase tank and using the overall mass conservation on the entire system. (2 refs.)

65331 Non-linear dynamic-impact simulation of process equipment tubes with tube/support plate interaction. R.G.Sauve, W.W.Teper (Nuclear Systems Dept., Ontario Hydro, Toronto, Ontario, Canada).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.740-51 vol.2

The occurrence of flow induced vibration fretting wear in process equipment such as heat exchangers and steam generators accounts for the majority of the failures due to vibration. One of the parameters which plays a vital role in the prediction of tube wear rate is the tube motion and resulting impact forces which occur when the tube response exceeds the clearance in the support plates and results in a collision. The impact and/or sliding forces which occur at interfaces lead to progressive thinning of tube walls and ultimate failure in the extreme case. (17 refs.)

65332 One-dimensional modeling of two-phase jet expansion and impingement. M.Epstein, R.Henry (Fauske & Associates Inc., Burr Ridge, IL, USA), W.Midvidy, R.Pauls.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.769-77 vol.2

A simple one-dimensional model of the free expansion of a highly underexpanded two-phase jet is formulated. The model is found to be in good agreement with available measurements of the center-line pressure decay in small- and large-scale free jet experiments. Moreover, it is demonstrated that existing measurements of the forces experienced by a target surface immersed in a two-phase jet are in reasonable agreement with standard type momentum balance formulations. (17 refs.)

65333 Fluid-structure interaction during LOCA blowdown. R.N.Oehlberg (Electric Power Res. Inst., Palo Alto, CA, USA), F.H.Chang, G.E.Santee,Jr., G.A.Mortensen, M.B.Gross, T.B.Belytschko.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.778-91 vol.2

A methodology for realistically analyzing three-dimensional fluid-structure interaction effects and the resulting hydrodynamic loads during the subcooled portion of a hypothetical loss-of-coolant accident in a pressurized water reactor is discussed. The methodology uses a hydrodynamic computer program, STEALTH 3D, coupled with a structural response program, WHAMSE 3D, to calculate the dynamic interaction of fluid and structure during a reactor vessel blowdown. This coupled program is user oriented and highly versatile in modeling the various components in complex reactor systems. Assessment of the methodology is provided by STEALTH/WHAMSE 3D calculations of blowdown tests in the German Battelle-Frankfurt RS-16B facility (Test DWR5) and the HDR facility (Tests V31.1 and V32). The calculations are described and the results compared with experimental data. Agreement between the calculational results and experimental data is good. (19 refs.)

65334 Flow-induced fatigue failure of structures. A sensitivity analysis. H.Fenech, A.Rao (Dept. of Chem. & Nuclear Engng., Univ. of California, Santa Barbara, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.792-802 vol.2
Several flow noise pressure power spectra are considered to determine the fatigue lifetime of a plate simply supported on all sides. These spectra are typical of far field turbulent flow, vortex shedding, circulation noise and flow impingement. Elasticity theory and the linear damage accumulation model are the basis of this analysis. Narrow band, broad band and resonance models are successively used in the lifetime prediction. The sensitivity of the fatigue lifetime of the plate on the input pressure power spectrum representation, the material properties, the damping factor, the amplitude and peak frequency of a narrow band noise is presented. (14 refs.)

65335 A figure-of-eight thermosyphoning stability model and its verification. P.Gulshani (Atomic Energy of Canada Ltd., Mississauga, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.840-8
A simple, linearized, one dimensional stability model of the flow oscillations observed in the RD-12 thermalhydraulic experimental rig is developed starting from the basic equations governing a homogeneous two-phase flow. This rig has the so-called figure-of-eight geometry similar to but simplified from that of a CANDU reactor. The flow oscillations are explained in terms of the two-phase fluid pressure oscillations and enthalpy transport delays and a general stability criterion is given. The predicted and observed periods and damping ratios are found to be generally in good agreement. Combined with a simple, analytic, steady-state model for the loop to determine approximate operating conditions, the stability model is used to generate stability maps for thermosyphoning conditions. (1 ref.)

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems .... See Entry 64588

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics .... See Entry 64589

Proceedings: Thermal Reactor Benchmark Calculations, Techniques, Results, and Applications (EPRI-NP-2855) (papers in summary form only received) .... See Entry 64595

A finite element method for neutron transport. VII. Completely boundary-free maximum principle for the first-order Boltzmann equation .... See Entry 65304

Stability analysis of the neutron transport equation with temperature feedback .... See Entry 65305

Plate vs. rod fuel elements in a tight-lattice water reactor .... See Entry 65336

One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. I. The analytical solutions .... See Entry 65339

One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. II. Numerical analysis .... See Entry 65340

Modeling heat and mass transfer in the core of a heat-emitting fuel element .... See Entry 65341

Nuclear reactivity of extractors with a variation in the concentration of fissionable materials in a nonsteady regime .... See Entry 65342

Buildup of ^{233}U with a specified content of ^{232}U by the irradiation of thorium in a water-cooled/water-moderated reactor (VVER) .... See Entry 65343

On the low-frequency spatial dependence of the neutron response and noise field in LWRs .... See Entry 65476

On the physical meaning of the fluid velocity measured in BWRs by noise analysis .... See Entry 65477

Identification of BWR feedwater control system using autoregressive integrated model .... See Entry 65479

Decontamination factors and release rates of UO_2 particles from boiling pools of sodium .... See Entry 65484

Two-phase flow instability in channels with sinusoidal heat supply .... See Entry 65485

Method for automatic monitoring of iodine radioactivity in the water coolant of an atomic power plant .... See Entry 65486

MAXI-LILLIPUT: a simplified model of a French pressurized water reactor power plant .... See Entry 65491

TRAC-BWR—a best estimate code for transient thermal hydraulic analysis of a BWR .... See Entry 65492

Modeling of containment response to the dispersive mode of PWR vessel failure .... See Entry 65493

Verified simulation of a nuclear reactor transient in real time: stuck pressurizer relief valve .... See Entry 65494

A three-dimensions kinetic code for PWR reactor .... See Entry 65495

A review of current heat transfer correlations used in reactor safety assessment .... See Entry 65497

Detailed modelling of two phase flow and its application to system prediction .... See Entry 65498

Condensation effects in reactor transients .... See Entry 65500

Lessons in reactor thermal-hydraulics from operating plant transients .... See Entry 65501

A review of flow-induced vibrations in reactors and reactor components .... See Entry 65502

Applied mathematical methods in nuclear thermal-hydraulics .... See Entry 65503

The application of a charnock-based estimate of interfacial stress to some near-horizontal, stratified two-phase flows .... See Entry 65515

Comparison of flashing heat transfer correlations .... See Entry 65523

Evaluation of predictability of multiple CHF events .... See Entry 65532

A simplified finite element model for fully developed axial turbulent flow in rod bundles .... See Entry 65535

Formulation of a two-fluid model for mixing in LWR bundles .... See Entry 65536

Application of a discontinuity-tracking-technique to thermal-hydraulics analysis .... See Entry 65537

A numerical algorithm for calculating steady-state flow splits .... See Entry 65538

A multigrid scheme for the thermal-hydraulics of a blocked channel .... See Entry 65539

Numerically induced pressure excursions in two-phase-flow calculations .... See Entry 65540

Application of a Taylor series approximation to represent the heat transfer constitutive relationships in thermal-hydraulic computer codes .... See Entry 65541

Comparison of FEBA test data with RELAP4/MOD6 postcalculations .... See Entry 65542

Analytical prediction of blowdown system experiments using DRUFAN .... See Entry 65543

A method for assessing reactor core cooling without forced circulation .... See Entry 65545

Natural circulation in boiling water reactors .... See Entry 65546

Natural circulation cooling characteristics during PWR accident simulations .... See Entry 65547

Reflux condensation in a vertical channel flow .... See Entry 65551

Degraded cooling in a CANDU .... See Entry 65552

Dryout of an inductively heated bed of steel particles with subcooled flow from below .... See Entry 65553

An analytical model for heat transfer in a pin-bundle presentation and first validation .... See Entry 65555

Semi-empirical model for friction factors in LMFBR wire-wrapped rod bundles .... See Entry 65556

Distributed parameter analysis of the thermal-hydraulic behavior of wire wrapped rods in LMFBR cores .... See Entry 65557

Experimental and numerical model for annular dispersed downward air/water flow in a venturi .... See Entry 65565

Analysis of PKL Test K9 by THYDE-P Code (CSNI ISP No.10 and THYDE-P sample calculation run 70) .... See Entry 65578

Applications of the RELAP5 code to the station blackout transients at the Browns Ferry Unit one plant .... See Entry 65583

Analysis of loss of feed water ATWS transients .... See Entry 65584

Analysis of station-blackout-ATWS with respect to surgeline pressure drop .... See Entry 65585

RELAP5/MOD1 analysis of turbine trip test 1 at Peach Bottom Unit 2 .... See Entry 65586

TRAC analysis of steam generator overfill transients for TMI-1 .... See Entry 65587

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Loss-of-Fluid Test findings in pressurized water reactor core's thermal-hydraulic behavior .... See Entry 65589

Development of a real time PWR accident simulator and its application for TMI-LOCA analysis .... See Entry 65590

Total nuclear plant simulation in real time .... See Entry 65591

Pre-test prediction of the TMI-1 turbine trip start-up test transient .... See Entry 65592

Unmitigated boron dilution events in a PWR .... See Entry 65593

Effects of the reactor coolant pumps after a small break in a Westinghouse reactor .... See Entry 65594

Reflood experiments in the REWET-II rod bundle facility including comparisons with computer calculations .... See Entry 65595

FLECHT-SEASET 21-rod bundle flow blockage heat transfer during reflood .... See Entry 65596

Investigation of radial power and temperature effects in large-scale reflood experiments .... See Entry 65597

The effect of inlet flow oscillations on reflooding of a tubular test section .... See Entry 65599

TRAC analysis of radial power distribution effects on forced-feed reflood experiments .... See Entry 65601

Two fluid modelling of the LWR core uncovery transients .... See Entry 65602

Application of analytical capability to predict rapid cladding cooling and quench during the blowdown phase of a large break loss-of-coolant accident .... See Entry 65603

Analytical study of BWR upper plenum behavior under LOCA by TRAC-BD1 .... See Entry 65604

Posttest analysis of Semiscale Tests S-UT-6 and S-UT-7 using TRAC-PF1 .... See Entry 65605

Large break integral test with the Two Bundle Loop and post-test analysis by RELAP5/MOD1 .... See Entry 65606

Fuel temperature excursions during accidents with degraded cooling in CANDU reactors .... See Entry 65608

A mechanistic hydrodynamics model for the simulation of BWR jet pumps during normal and off-normal operation .... See Entry 65613

FRAP-T6 uncertainty study of LOCA tests LOFT L2-3 and PBF LLR-3^a .... See Entry 65615

Numerical simulation of thermal and fluid mixing in the cold leg and downcomer of a model geometry during a PWR primary side overcooling .... See Entry 65618

Thermal-hydraulic analysis of main-steam-line-break accidents as potential initiators for reactor vessel pressurized thermal shock .... See Entry 65619

Stability analyses of boiling water systems and steam generators .... See Entry 65621

Characteristics of PWR ice condenser containment during degraded core and full core meltdown accidents .... See Entry 65622

The effect of steam bypass on ice condenser containment pressurization .... See Entry 65623

Containment response analysis in TRAC-BD1/MOD1 .... See Entry 65624

Calculation of the thermal-hydraulic transient in multicompartment systems, by ARIANNA computer codes .... See Entry 65625

Containment code verification by systematic evaluation of experimental data .... See Entry 65626

The multi-compartment-code 'WAVCO', developed to analyse the behaviour of non-condensables during hypothetical accidents .... See Entry 65627

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Formulating a post accident temperature profile inside containment for the Oyster Creek BWR—approach and key parameter identification ....See Entry 65630

Containment condensing heat transfer ....See Entry 65633

Research on the behaviour of Mark II pressure suppression containment system during LOCA, carried out at the University of Pisa ....See Entry 65634

Development and applications of a computer program for modelling the response to hydrogen burns in containment ....See Entry 65643

Synthesis of clad motion experiments interpretation: codes and validation ....See Entry 65651

Fuel penetration of intersubassembly gaps in LMFBRs (a calculational method with the SIMMER-II code) ....See Entry 65655

Two-dimensional steady-state thermal and hydraulic analysis code for prediction of detailed temperature fields around distorted fuel pins in an LMFBR assembly: SPOTBOW ....See Entry 65656

Investigation of flow recirculation in a rod bundle during natural-convection flow and power transients ....See Entry 65657

BLOWAES: a method for evaluating blowdown two phase flowrate from pressure and thrust measurements ....See Entry 65659

On the use of penetration depth in thermal transient finite element analysis ....See Entry 67297

28.42 FISSION REACTOR MATERIALS

65336 Plate vs. rod fuel elements in a tight-lattice water reactor. Y.Ronen, A.Sharon (Dept. of Nuclear Engng., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Ann. Nucl. Energy (GB), vol.10, no.5, p.277-80 (1983).
The possibility of using plate fuel elements in tight-lattice water reactors instead of rod fuel elements is explored. For this purpose the authors compared the thermal-hydraulic and neutronic aspects of plates with those of rod fuel elements. Because of the fact that plates have a higher mechanical strength than rods with equal dimensions, it is possible to reduce the thickness of the plates and thus reduce the centerline temperature. This fact and other thermal-hydraulic considerations demonstrate that plate fuel elements are safer than rods with respect to their resistance to LOCA. Preliminary neutronic calculations indicate that plates and rods have about the same neutronic characteristics. (22 refs.)

65337 Measurements of stresses, forces and moments on nuclear steam generators. M.T.Flaman, N.N.Shah (Dept. Mech. Res., Ontario Hydro Res. Div., Toronto, Ontario, Canada).
Exp. Mech. (USA), vol.23, no.1, p.10-14 (March 1983).
Regulator demands required that strain-gage measurements be made on a steam drum/steam generator assembly to ensure that ASME code limits would not be exceeded during operation. The major difficulty in the performance of this measurement project was centered primarily on the lack of accurate information on the thermal-expansion behavior of the components to be instrumented. In addition, another difficulty in the performance of the measurements was the effect of unknown through-wall thermally induced stresses on the strain-gage readings. To overcome these significant obstacles, an unconventional measurement approach was developed for the analysis of strain-gage measurements. This approach enabled known information on internal steam-generator steam pressure to be substituted for the unknown information (as described above) which is usually required for strain-gage analysis. This approach has been successfully verified and may have widespread applicability for other measurement projects which face the same commonly encountered difficulties. (4 refs.)

65338 The effect of composition and radiation on the fracture of a nuclear waste glass. J.L.Routbort, H.Matzke (Comm. of the European Communities, European Inst. for Transuranium Elements, Karlsruhe, Germany).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.229-37 (April 1983).
The Hertzian indentation technique has been used to determine the surface fracture energy γ_F and the fracture toughness K_{Ic} of a borosilicate glass (Versuchsglas type 98/12) developed to contain high level nuclear waste. Using spherical steel indenters whose radii were varied between 1.5 and 7.0 mm, the critical load P_c for crack formation was determined. P_c is a linear function of the indenter radius which does not pass through the origin. This failure of Auerbach's law may be due to the statistical nature of the flaw distribution. Nevertheless, the data are used to estimate that $K_{Ic}=1.77\pm0.15$ MN $m^{-3/2}$. Adding selected groups of fission products to the base glass leaves K_{Ic} unchanged. The addition of lead to the glass or bombardment with 300 keV lead ions lowers K_{Ic} by approximately 20%. This may be due to replacement of Si-O bonds by Pb-O bonds which are weaker. Radiation with 77 MeV α particles to a dose of 1.3×10^{15} α particles cm^{-2} increases K_{Ic} by approximately 75%. It is concluded that neither the radiation used here nor the simulated fission products will seriously degrade the fracture properties of the nuclear waste glass investigated. (19 refs.)

65339 One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. I. The analytical solutions. K.Grysa, Z.Kozlowski (Tech. Univ. of Poznan, Poznan, Poland).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.1-14 (Jan. 1983).
The authors approximate analytical and exact solutions of the problems of heat flux and temperature determination on slabs. The problems are considered on the ground of the theory of thermoelasticity. The interior thermal and mechanical responses are used in determining the unknown functions describing heat flux and temperature of the surface of a slab. (11 refs.)

65340 One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. II. Numerical analysis. Z.Kozlowski, K.Grysa (Tech. Univ. of Poznan, Poznan, Poland).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.15-24 (Jan. 1983).
For pt.I see ibid., vol.74, p.1-14 (1982). The authors present a thorough analysis of an identification process that has been analytically described in the first part. The conclusions have shown some new aspects of the problem and are confirmed by brief additional analytical considerations. (1 ref.)

65341 Modeling heat and mass transfer in the core of a heat-emitting fuel element. V.A.Kornilov, V.D.Yuditskii.
Sov. At. Energy (USA), vol.53, no.2, p.525-8 (Aug. 1982). Translation of: *At. Energ. (USSR),* vol.53, no.2, p.74-6 (Aug. 1982). [received: April 1983]
By the method of computer modeling, the heat and mass transfer of oxide fuel in a cylindrical heat-emitting fuel element is investigated, with exhaust of the gaseous fission products through a gas flue in the form of a central tube. The mathematical formulation of the nonsteady three-dimensional problem of heat and mass transfer in a fuel element as a problem for a multicomponent system of bodies with moving phase boundaries is given. (4 refs.)

65342 Nuclear reactivity of extractors with a variation in the concentration of fissionable materials in a nonsteady regime. T.Zoltowski (Inst. of Nuclear Res., Warsaw, Poland).
Sov. At. Energy (USA), vol.53, no.2, p.540-3 (Aug. 1982). Translation of: *At. Energ. (USSR),* vol.53, no.2, p.86-8 (Aug. 1982). [received: April 1983]
The criticality of extraction units has important significance. The extraction process performed in a multistage device (in the counterflow) is highly nonlinear; therefore, it is accurate to describe the phenomena occurring in the unit as very complicated. The distribution and variation of the concentration in the individual stages of the device depend on the initial parameters; the plutonium concentration in the aqueous phase can be subjected to the greatest perturbation. A device for the extraction of a large amount of fissionable materials cannot always have absolutely safe geometry. In this connection, control of the criticality of the device is directly related to control of the concentration distribution in the stages of the device. The appearance of nonuniformity in the distribution of fissionable materials in an extraction can result in too large an increase in the nuclear reactivity of the system. A.M. Rozen et al. (1979) have calculated the profiles of the plutonium concentration and determined the conditions under which a peak in the plutonium concentration is created in a steady-state or transitional process. They assume that this can lead to a critical state. The author checks the postulate of Rozen et al. and determines the variations of the reactivity when a critical concentration profile is attained. (7 refs.)

65343 Buildup of ^{233}U with a specified content of ^{232}U by the irradiation of thorium in a water-cooled/water-moderated reactor (VVER). A.A.Polyakov, V.P.Rukhlo, Yu.E.Titarenko, S.F.Komin.
Sov. At. Energy (USA), vol.53, no.2, p.561-2 (Aug. 1982). Translation of: *At. Energ. (USSR),* vol.53, no.2, p.106-7 (Aug. 1982). [received: April 1983]
When thorium is irradiated in reactors, it is necessary to reduce the buildup of ^{232}U with respect to ^{233}U. A reduction of $N^{232}U/N^{233}$ can be achieved by inserting certain inert diluents into the thorium rods. Based on an analysis of the nuclear-physics and technological properties, zirconium dioxide was chosen as such an inert diluent. A detailed investigation of the effect of a different concentration of ZrO_2 in ThO_2 rods on the formation of ^{233}U and the determination of the ratio of the concentrations $N^{232}U/N^{233}U$ was conducted on a subcritical uranium—water test-rig, for which the neutron source was the IRT reactor. (4 refs.)

65344 The behaviour of gaseous and organic impurities in the coolant of a nuclear power station with channel type uranium-graphite boiling reactors. V.A.Mamet, N.I.Bogdanov, V.F.Tyapkov, V.A.Yurmanov, G.A.Andropova, A.V.Arkhipenko, S.F.Erpyleva.
Therm. Eng. (GB), vol.29, no.7, p.364-7 (July 1982). Translation of: *Teploenergetika (USSR),* vol.29, no.7, p.14-17 (July 1982). [received: Feb. 1983]
The ratio of radiolytic gases (H_2 and O_2) in the steam is found to differ from the stoichiometric values. The most probable cause is the admission of ion-exchange resins or their decomposition products and oils. Acid compounds predominate owing to thermoradiolysis of organic materials. (7 refs.)

65345 The effect of the products of decomposition of ion exchange resins on the pH of the coolant of a boiling reactor. V.Ya.Bredikhin, L.N.Moskvin.
Therm. Eng. (GB), vol.29, no.7, p.368-70 (July 1982). Translation of: *Teploenergetika (USSR),* vol.29, no.7, p.17-19 (July 1982). [received: Feb. 1983]
To forecast the nature of disturbances to water-chemistry conditions of a station with an RMBK-1000 reactor with entry of ion exchange resins into the multistage forced circulation circuit, investigations were carried out on an experimental reactor of boiling type. The findings are discussed. (13 refs.)

65346 Optical probe for steam generator tube dent measurement. D.L.Oberg.
Report EPRI-NP-2863, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 56 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
This report documents one of a series of projects to develop nondestructive examination methods, focusing on a check for denting at the intersection of the tube and the tube support plate. The design of an optical profilometer to measure tube denting and the construction of prototype and field-hardened devices are detailed.

65347 Examination of tube samples 21-46 and 28-45 from the Ginna Nuclear Plant for intergranular attack. L.W.Sarver, E.B.S.Pardue.
Report EPRI-NP-2877, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 274 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
Details the destructive examination of tubes pulled from the Ginna nuclear power plant to characterize intergranular attack. The metallurgical and deposit chemistry data obtained from the samples are discussed, and the mechanisms of action of the suspect substances are discussed.

65348 Twenty-six-inch pipe NDE instrument surveillance test. R.L.Bickford, R.A.Clark, S.L.Crawford, J.F.Dawson, S.R.Doctor, P.H.Swift.
Report EPRI-NP-2869, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 122 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
This report describes the initiation and growth of intergranular stress corrosion cracking in the weld-heat-affected zone of a pipe specimen. Tests on a 26-inch-diameter type-304 stainless steel pipe exposed to high-purity oxygenated water and subjected to a sustained axial stress are detailed. Use of these tests in developing nondestructive examination techniques to detect and monitor cracking is discussed in terms of various methods including dye penetrant, ultrasonic, radiography, electrical resistivity, gauging, and acoustic emission.

65349 Nondestructive evaluation program: Progress in 1982. G.J.Dau, A.Armor, M.E.Lapides, S.N.Liu, T.Oldberg, J.R.Quinn.
Report EPRI-NP-2728-SR, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 458 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
A comprehensive review of the EPRI nondestructive evaluation program, including contractor-supplied progress reports of each current project grouped by plant components, is presented. An organizational plan of the program is summarized from the viewpoints of in-service inspection operations, R&D personnel, and utility representatives. This report also serves as the proceedings for the EPRI nondestructive evaluation information meeting that was held in Charlotte, North Carolina, on November 2-3, 1982.

65350 Verification of core-fuel inventory of a fast critical facility by monitoring reactor physics parameters. M.Obu, K.Koyama, H.Kuroi.
Report JAERI-M-82-153, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Nov. 1982), 26 pp.
On the safeguards problem, the technical feasibility was studied for experimentally verifying the core-fuel inventory of a fast critical facility. The FCA Assembly VIII-1 with a plutonium-fuelled test zone was used for this

purpose. Six loading patterns were chosen in the verification experiment to simulate the diversion of Pu-fuel from the core. The Pu-fuel removed from the core was about 3.5-5.8 kg. Verification techniques are based on the monitoring of small changes in fission rates and β/l caused by the diversion of some amount of Pu-fuel. The fission rates were measured by a fission chamber technique with a hundred ^{239}Pu fission chambers located in the core region and multi-chamber scanning electronics, while β/l values were measured by power noise analysis with two helium-3 chambers. The verification experiment indicates that the fission rates and β/l monitor follow the quantities of plutonium removed from the core. It is concluded that the verification of core-fuel inventory is feasible using the present monitoring method. (3 refs.)

65351 Final report on thw UKAEA defect detection trials on test pieces 3 and 4. December 1982. D.L.Lock, K.J.Cowburn.
Report ND-R-912(R), UKAEA, Risley, Lancs., England (March 1983), 51 pp.
This report follows ND-R-845(R) which described the scope, inspection procedures and results of the defect detection trials on test pieces 3 and 4. The work has been aimed at assessing the ability of non-destructive testing techniques, to detect and size defects near the clad/base metal interface of a flat plate test piece and the inner radius of a PWR inlet nozzle. Following the destructive examination of the test pieces at Ispra, the true sizes of the intended defects are now known. These sizes are compared with that intended and the performance of the inspection teams reviewed. (3 refs.)

65352 Low-level radwaste solidification. R.F.Tucker,Jr., R.A.Nelson, C.C.Miller.
Report EPRI-NP-2900, Electr. Power Res. Inst., Palo Alto, CA, USA (March 1983), 226 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
State-of-the-art low-level radwaste solidification processes and systems currently in use and under development are assessed. Types of waste, solidification agents, and general criteria affecting radwaste solidification technologies are identified; chemistry and physics of the processes are discussed; and technical descriptions of 22 commercially available solidification systems, information on radwaste packaging efficiencies for specific wastes, and descriptions of radwaste shipping and burial containers along with container handling and storage systems are provided.

65353 The use of asymptotic expansions to determine the short- and long-term leaching behaviors of nuclear waste forms. C.Pescatore, A.J.Machiels (Univ. of Illinois, Urbana, IL, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.283-5, vol.2
Several mathematical models have been formulated to describe leaching of nuclear waste forms. Given a model which can be rather elaborate, the use of asymptotic analysis allows one to extract with relative ease the short-term leaching behavior—well documented by laboratory experiments—as well as the long-term leaching behavior not directly verifiable by experimentation. The usefulness of the technique is limited by the requirement that the model to analyze be properly linearized. (10 refs.)

65354 Thermomechanical problems in nuclear waste using the explicit finite-difference method. R.Hofmann (Sci. Applications Inc., San Leandro, CA, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.286-7, vol.2
Discusses Lagrange explicit finite-difference (LEFD) techniques which are among several distinctly different approaches that are being used for solving complex, thermomechanical response waste isolation problems. The main attributes of the LEFD techniques are their ability to handle large and small strains, constitutive nonlinearities, and both quasi-static and transient response. The STEALTH computer code system developed for the Electric Power Research Institute, is the most advanced LEFD code available for solving a variety of thermomechanical nuclear waste problems. (10 refs.)

65355 Application of systems variability analysis to assess environmental impacts in the Canadian nuclear fuel waste management program. T.H.Andres (Whiteshell Nuclear Res. Establ., AECL, Pinawa, Manitoba, Canada).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.291-1a, vol.2
Atomic Energy of Canada Ltd. has recently embarked on a 10-year generic research program to assess the concept of geologic disposal of nuclear fuel wastes. It is necessary to know what impact disposal would have on future generations. It is not possible to predict exactly what would happen to buried wastes; however, it is hoped that it is possible to describe, in a statistical sense, what could happen due to natural processes. That is, to associate a probability with each level of impact that could occur. The procedure used to estimate such probabilities is called System Variability Analysis, currently performed using a computer program called SYVAC. (no refs.)

65356 UK developments in structural integrity aspects of NDT. A.Rogerson, P.J.Highmore (UKAEA, Risley, England).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.7/1-32
Considerable advances have been made in the field of ultrasonic nondestructive testing over the past few years. Some of these developments are reviewed in the context of the safe operation of a UK pressurised water reactor (PWR) by ensuring the structural integrity of the reactor pressure vessel (RPV). (27 refs.)

65357 Some aspects of work in the UK relating to PWR structural integrity. B.J.Darlaston (Berkeley Nuclear Labs., CEGB, Berkeley, England).
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.20/1-27
Until recently much of the effort on structural integrity has been focussed on the pressure vessel. Although this is a key component many of the restraints on the vessel are related to the postulation of failure of other components in the primary pressure boundary, for example, loop pipe failure. More recently it has been recognised that the pressure vessel does not, by exemption, remove the need for attention to be paid to other components. The steam generator, loop pipework, pump, valves, pressuriser, surgeline and main steamline all have their interesting facets. One vital issue relating to much of the research work undertaken in the field of structural mechanics is the need for validation of an assessment procedure or technique. It is in this respect there is an element of dependence on overseas programmes particularly those in the USA sponsored by EPRI, NRC and DOE and in Germany at KWU and MPA. These programmes are continually reviewed in the light of the UK needs. (15 refs.)

65358 The susceptibility of SA-508-II and SA-533B to reheat cracking-evaluation of empirical and theoretical predictive methods. P.S.Ayres, S.B.Abston (Babcock & Wilcox, Cleveland, OH, USA), D.Bieber, W.Schellhammer.
8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems, Stuttgart, Germany, 14-15 Oct. 1982 (Stuttgart, Germany: Staatliche Materialprufungsanstalt Universitat Stuttgart 1982), p.21/1-33
Presents the results obtained in a program for which the primary objective was to evaluate various empirical and theoretical methods for predicting reheat cracking [i.e., stress relief cracking (SRC)] in commercial size heats of nuclear pressure vessel steels of the SA-508-II and SA-533B types. The approach taken was to use theoretical predictive methods to select both crack-susceptible and non-crack-susceptible heats from archive materials of commercial heats of material used in nuclear vessel construction. The program then carried out an extensive experimental evaluation of these heats of material using both a production submerged arc (austenitic) cladding process and a production submerged arc (ferritic) structural welding process; these two processes exposed the materials to differing degrees of restraint (stress) and welding heat input. Included in this experimental evaluation was complete metallographic characterization of each heat of material, with particular attention being given to regions exhibiting cracking. (6 refs.)

65359 An experimental comparison of alternative solid forms for Savannah River high-level wastes. J.A.Stone (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.1-8
Samples of borosilicate glass, high-silica glass, tailored ceramic, and SYNROC, incorporating simulated Savannah River high-level defense waste sludges, were leached by the MCC-1 procedure for times up to 28 days. Cesium, uranium, and cerium leach rates are reported for waste forms containing a composite sludge, at 40°C in deionized water, and at 90°C in deionized water, silicate water, and brine. The ordering of the waste forms from best to worst differs for each element leached, and none of the forms show a clear advantage for all the key radwaste elements. Some cesium leach rates for forms containing high-aluminum or high-iron sludges also are presented. So far, only small effects of sludge type have been observed, with one exception. This study is one of several inputs for selection of an alternative waste form for Savannah River waste. (11 refs.)

65360 Processing effects on the behavior of titanate waste forms in aqueous solutions. R.G.Dosch (Sandia Nat. Labs., Albuquerque, NM, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.15-22
Titanate processing parameters including temperature, waste loading, redox conditions, and additives used to promote specific phases were evaluated with respect to their effect on leaching of Cs, Mo, Ca, Sr, Ba, U, Gd, and Ti in the range of 22°-150°C in leachates which included deionized water, acidic (pH 2), and basic (pH 12) solutions. Surface analyses and microstructural characterization were used to relate observed leaching behavior to processing parameters. Redox conditions were found to be very important with respect to Cs (and Mo) retention. Two Cs-bearing phases were found in titanate prepared under oxidizing conditions. One had a hollandite structure and the other contained Cs, Mo, Ca, and Fe as major constituents. The latter phase, which was more susceptible to leaching, was not observed in titanates prepared using adequate reducing conditions. Where applicable, a reference glass (PNL 76-68) was included in the leaching tests. (10 refs.)

65361 Iron-enriched basalt for containment of nuclear wastes. J.M.Welch, R.P.Schuman, C.W.Sill, P.V.Kelsey,Jr., S.P.Henslee, R.L.Tallman, R.M.Horton, D.E.Owen, J.E.Flinn (EG&G Idaho Inc., Idaho Falls, ID, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.23-30
Iron-enriched basalt (IEB) has been investigated as a containment medium for defense transuranic (TRU) and defense high-level wastes. IEB samples have been fabricated incorporating simulated and actual defense TRU wastes generated at the Rocky Flats Plant, and simulated defense high-level wastes. These samples were tested for leaching resistance and fracture toughness. Cesium and strontium volatility from an IEB melt was also assessed, using radioactively spiked samples. (8 refs.)

65362 Studies of pollucite. E.R.Vance, B.E.Scheetz, M.W.Barnes, B.J.Bodnar (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.31-5
Pollucite ($CsAlSi_2O_6$) has been suggested as a suitable phase for the incorporation and immobilization of ^{137}Cs, on the basis of its refractory nature and leach resistance. The phase also occurs in tailored ceramic formulations designed for the disposal of commercial reprocessing waste and zeolites which are heavily loaded with Cs. Pollucite itself occurs in nature as a mineral. The Cs is held in 12-fold coordination in a zeolite-like aluminosilicate framework. Other alkalis may be present, though H_2O molecules must be incorporated if Na or K is present. The present work addresses several aspects which may be relevant to the use of pollucite in nuclear waste management and which have not been dealt with in much detail by other workers. These aspects are (i) possible range of stoichiometry at high temperatures, (ii) incorporation of cations other than Cs, Al or Si, (iii) compatibility with other phases occurring in tailored-ceramic formulations, (iv) crystallization kinetics and possible sintering aids, (v) radiation damage response, (vi) transmutation stability and (vii) compatibility with cements. (18 refs.)

65363 Immobilization of Savannah River high-level wastes in SYNROC: results from product performance tests. J.H.Campbell, C.L.Hoenig, F.Bazan, F.J.Ryerson, R.Rozsa (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.49-57
Large samples (up to 15 cm diameter) of SYNROC D containing simulated Savannah River waste sludge have been prepared and performance tested.

Waste loadings of 60-65 wt.% for the SRL composite sludge have been achieved; this corresponds to a waste concentration (volumetric) loading of approximately 2.3-2.5 g/cm^3. A typical SYNROC D sample has a density of about 4.0 g/cm^3 with less than 0.2% porosity. The compressive and flexural strengths of SYNROC D are 51200 and 9400 psi, respectively and Young's Modulus is 20.1×10^6 psi by ultrasonic measurement. The quantity of respirable fines (less than 10 μm) generated during a constant energy density impact (10 J/cm^3) was less than 0.16 wt.%. Values for the thermal conductivity (22°C) and the thermal expansion coefficient (22-950°C) were measured to be 1.7 W/m.K and 11×10^{-6} K^{-1}, respectively. Normalized elemental leach rates determined by 28-day MCC-1 tests (90°C) for Cs, Sr, U and Nd are 0.7, 0.3, 5×10^{-5} and $<8\times10^{-3}$ g/m^2.d, respectively. (15 refs.)

65364 The application of ^{57}Fe Mossbauer spectroscopy to the characterization of nuclear waste forms. P.G.Huray, M.T.Spaar, S.E.Nave, J.M.Legan (Phys. Dept., Univ. of Tennessee, Knoxville, TN, USA), L.A.Boatner, M.M.Abraham.
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.59-66
The electronic charge states and site symmetries of the radioactive ions incorporated in nuclear waste forms are of considerable importance in determining the physical and chemical properties of these materials. An in situ characterization of these ions is, unfortunately, often difficult—especially when a mixture of charge states and local crystal symmetries exist. The application of Mossbauer spectroscopy represents a powerful technique for obtaining solid state chemical information. The Mossbauer isotope ^{57}Fe has been employed in examining the fractions of these nuclei present in mixed atomic environments in a variety of waste forms. The effects of heat treatment at various temperatures, reducing atmospheres, and diverse preparation procedures, were investigated. In many cases a comparison of the resulting spectra with the spectra of well-characterized compounds permitted a quantitative stoichiometric identification to be made of a fraction of the Mossbauer nuclei. In some instances only the charge states and local crystal distortions could be determined. (3 refs.)

65365 XPS valence state determination of Np and Pu in multicomponent borosilicate glass and application to leached 76-68 waste glass surfaces. D.P.Karim, D.J.Lam, H.Diamond, A.M.Friedman (Argonne Nat. Lab., Argonne, IL, USA), D.G.Coles, F.Bazan, G.L.McVay.
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.67-73
Current plans for high-level radioactive waste disposal call for long term emplacement of canisters of a suitably leach resistant waste form in deep underground repositories. The present study involves the use of X-ray photoemission spectroscopy (XPS) to examine the behavior of actinides at the surface of glasses. XPS is an inherently surface sensitive technique, probing the use to provide quantitative compositional information by monitoring the intensity outermost 20-30 Å of a sample. The technique is routinely used to provide quantitative compositional information by monitoring the intensity of photoemitted electrons from core levels characteristic of specific elements as a sample is illuminated with monochromatic X-rays. In some cases, small changes in the binding energies of these core levels (chemical shifts) can be used to get specific information on the environments and chemical states of ions in a solid. Prior to this study, little work has been done to establish procedures for determining Np or Pu oxidation states in silicate glasses from XPS spectra. Based on experience with U^{+4} and U^{+6} in glasses, the authors hoped that chemical shifts of the Np and Pu 4f core lines would provide convenient signatures for the respective actinide oxidation states. (7 refs.)

65366 Immobilization of high level nuclear reactor wastes in SYNROC: a current appraisal. V.M.Oversby, A.E.Ringwood (Res. School of Earth Sci., Australian Nat. Univ., Canberra, Australia).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.75-81
Results are presented for leach testing at 95°C and 200°C of SYNROC containing 9% and 20% simulated high level radioactive waste, synthetic hollandite and perovskite samples, and natural zirconolite and perovskite samples. Single phase synthetic minerals show much higher leach rates than natural mineral samples and polyphase SYNROC samples. Natural zirconolite samples with low radiation damage have leach rates at 200°C based on U which are identical to those measured on SYNROC samples. Natural zirconolites with very large accumulated α dose and radiation damage have leach rates at 200°C which are only 5 times higher than those of low dose samples. (7 refs.)

65367 Rutherford backscattering investigation of the corrosion of borosilicate glass. B.C.Sales, L.A.Boatner, H.Naramoto, C.W.White (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.83-90
One of the primary reservations about the use of borosilicate glass as a primary nuclear waste form is the leaching of radionuclides from the glass by water above 75°C. To study this process, examination of the surface layer is necessary. The technique of depth profile analysis by means of Rutherford backscattering has been used to study the evolution of the leaching process and associated changes in chemical composition of the leached borosilicate glass surface layer. (9 refs.)

65368 The development and testing of SYNROC C as a high level nuclear waste form. K.D.Reeve, D.M.Levins, E.J.Ramm, J.L.Woolfrey, W.J.Buykx (Australian Atomic Energy Comm. Res. Establ., Sutherland, Australia).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.99-106
The current status of SYNROC C research and development by the Australian Atomic Energy Commission is reviewed. A non-radioactive fabrication demonstration line designed to produce 10 cm o.d., 90 cm long, cylinders of SYNROC canned in stainless steel by the method of in-can hot pressing is being commissioned. Leach tests are proving the excellent leach resistance of SYNROC. Accelerated radiation damage testing using fast neutrons has simulated storage times of up to 6.7×10^5 years. Thermophysical properties of SYNROC have been measured over the temperature range 20-650°C. (14 refs.)

65369 Immersion and leach tests on solidified decontamination wastes from Dresden Unit 1. R.E.Barletta, J.W.Adams, R.E.Davis (Nuclear Waste Management Div., Brookhaven Nat. Lab., Upton, NY, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.141-6
In order to provide technical support to the NRC, Brookhaven National Laboratory has performed leach tests and immersion tests using organic liquids and organic saturated water of concentrated decontamination waste solidified using a vinyl ester-styrene binder. Immersion tests of waste forms prepared at a solidification demonstration held at the Dresden Nuclear Power Station were conducted in toluene, xylene, and water saturated with toluene and xylene. (4 refs.)

65370 Stability of I and Sr radiophases in cement matrices. M.W.Barnes, B.E.Scheetz, L.D.Wakeley, S.D.Atkinson, D.M.Roy (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.147-54
This study is a portion of a comprehensive research program that is examining the stability of a variety of nuclear waste forms. In addition to the bulk waste forms, important individual radiophases are being studied to obtain a more complete understanding of the behavior of the components of complex multiphase radwaste systems. The stability of the strontium radiophase in supercalcine and an iodine-radiophase will be discussed. The strontium radiophase in this study was Sr-powellite and the iodine radiophase was I-sodalite. Each radiophase was incorporated into bulk compositionally adjusted portland and aluminate cements. Two processing variables were studied: curing at 60°C and warm pressing at 150°C and 345 MPa. Sr-powellite in portland cement leaches incongruently; a combination of dissolution and diffusion-controlled exchange of Ca for Sr is demonstrated. In the warm-pressed aluminate cement these reactions are masked by reactions with the curing cement. I-sodalite leaching data indicate dissolution, dominant at long times, combined with diffusion, dominant at short times. (9 refs.)

65371 The system $SrMoO_4$-$BaMoO_4$-$CaMoO_4$: compatibility relations, the implications for supercalcine ceramics. B.E.Scheetz, W.P.Freeborn, J.Pepin, W.B.White (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.155-62
The stability of a tailored ceramic waste form under hydrothermal conditions was the subject of several previous papers. This is a report of an attempt to experimentally determine the phase relations in the alkaline-earth molybdate (Ca, Sr, and Ba) and verify a previous interpretation. For this work, the authors prepared compositions throughout the ternary system and heated them at 1200°C for periods of 2 to 24 hours. The experimental products were characterized by X-ray diffraction and SEM/EDX examination. New, calcium-rich compositions are suggested for the scheelite-structure phases in the supercalcine-ceramics based upon the interpretation of data from this study. This observation forces a re-examination of the assumption concerning the partitioning of Sr and Ba amongst the phases in the supercalcine-ceramic. (14 refs.)

65372 Leaching studies of crystalline sodium phases in nuclear waste forms. E.R.Vance, T.Adl (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.163-71
The immobilization of non-radioactive Na in nuclear waste has not been given much attention. However, since Na compounds are normally very soluble, Na-bearing phases may render a waste form more susceptible to leaching of radionuclides. The Na-phases may incorporate radionuclides and also, leaching of soluble Na phases will increase the surface area of the waste form. The crystalline Na-bearing phases which might occur in tailored ceramic formulations for nuclear waste are nepheline, magnetoplumbite and sodalite-type materials. Other Na phases which might occur in titanate-tailored or titanate-encapsulated forms are perovskite, $Na_2Ti_3O_7$ (especially in titanate-encapsulated materials) and Na_2TisiO or $Na_2Ti_2Si_2O_9$, etc., if the waste contained sand or zeolites. Sphene is of interest since it should be resistant to silica-rich ground water and it also can contain Na. Acmite is an alteration product of hydrothermally-treated PNL-76-68 glass. Na-bearing phosphates may occur in phosphate-tailored ceramics designed to immobilize transuranics in monazite. The present work concerns the reaction of the above materials with aqueous media in the temperature range 25-300°C. The phosphates studied were $NaTi_2(PO_4)_3$ and $NaZr_2(PO_4)_3$ which are relatively insoluble in boiling water. Other materials studied were $NaFeO_2$, Na_2ZrSiO_5 and $Na_2ZrSi_2O_7$. (23 refs.)

65373 Lanthanide orthophosphates as a matrix for solidified radioactive defense and reactor wastes. M.Petek, M.M.Abraham, L.A.Boatner (Solid State Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.181-6
Previous investigations have shown that the lanthanide orthophosphates (i.e. analogs of the mineral monazite) are promising candidate waste forms for the storage of high-level actinide or TRU wastes. In the present work, the properties of lanthanide orthophosphates loaded with simulated Savannah River defense wastes and simulated reprocessed light water reactor wastes have been investigated with the goal of evaluating the potential of these materials as advanced primary waste forms. (4 refs.)

65374 The use of ^{222}Rn as a flow path monitor for studies of radionuclide transport in fissures. J.Hines, D.Cohen, S.Fried, A.M.Friedman (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.187-9
A technique has been developed using ^{222}Rn as a flow path monitor. Its principle advantage over other radiotracers or dyes is that while the Kd of Rn gas in water solution is zero and hence follows the water path, its ^{210}Pb daughter is retained strongly by rock. The immobilized ^{210}Pb is not subject to diffusion, an important consideration in the proposed Nevada Field Test. To evaluate the technique, a series of laboratory scale experiments have been

performed. Artificial fissures consisting of glass plates and prepared flat surfaces were coupled to insure well characterized fissures. Water solutions of radiotracer were metered through these fissures and the discharge monitored to produce breakthrough curves as a function of flow rate. The rock surfaces were analysed for radionuclide concentration and the rock sectioned for diffusion profile into the rock. (no refs.)

65375 Formation and properties of americium colloids in aqueous systems. U.Olofsson, B.Allard, K.Andersson, B.Torstenfelt (Dept. of Nuclear Chem., Chalmers Univ. of Technol., Goteborg, Sweden).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.191-8

The formation and sorption properties of colloidal americium in aqueous solutions have been studied with variations of pH (2-12), ionic strength (0.01-1.0 M $NaClO_4$), americium concentration (10^{-7}-10^{-11} M) and storage time (6 h-6 months). A large fraction of the americium is sorbed on the container walls or on Al_2O_3 in the pH range 7-11. Around pH 5-8 and at pH above 12 centrifugable fractions (particle sizes greater than 100 nm) are obtained. The fractions formed at pH above 12, which seems to be a true hydroxide colloid, migrates through an Al_2O_3-filled column with very little retention. The average charge of americium species in solution changes from positive values at pH below 7-8 to negative values at pH above 10-11, as indicated from electromigration studies. (6 refs.)

65376 Site characterisation for field radionuclide migration studies in Climax granite. D.Isherwood, E.Raber, R.Stone (Lawrence Livermore Nat. Lab., Livermore, CA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.199-206

Radionuclide migration experiments in fractured granite at the Climax Stock, Nevada Test Site, are needed to compare field and laboratory measured retardation factors to determine whether laboratory studies accurately reflect in situ conditions. Initial field activities have concentrated on hydrological investigations to determine whether the fractures in Climax granite are suitable for migration experiments. A critical question was whether one could isolate a single vertical fracture between two boreholes and establish flow along that fracture from an upper to a lower borehole. In two fractures, the authors were able to establish a circulating system with up to 95 percent of the injected water being recovered. Constant pressure injection tests were conducted. Intrinsic permeabilities of 33 and 75 $(\mu m)^2$ were estimated using a radial non-steady flow model. These values correspond to effective fracture apertures of 20 and 30 μm respectively. Concurrent with the hydraulic testing activities is a study of the Climax ground-water chemistry. This paper includes the results of the hydrogeological and geochemical investigations, and describes the overall experimental design plans for the radionuclide migration experiments. (9 refs.)

65377 Nuclide migration field experiments in tuff, G tunnel, Nevada Test Site. B.R.Erdal, R.S.Rundberg, W.R.Daniels, K.Wolfsberg (Los Alamos Nat. Lab., Los Alamos, NM, USA), A.M.Friedman, S.Fried, J.J.Hines.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.207-13

A project to begin to address the phenomena of flow and element migration in fractured porous rock has recently been started by the Los Alamos National Laboratory, Sandia National Laboratories, and Argonne National Laboratory. The work has three objectives: (1) to develop the experimental, instrumental, and safety techniques necessary to conduct controlled, small-scale, radionuclide migration, field experiments; (2) to use these techniques to define radionuclide migration through rock by performing generic, at-depth experiments under closely controlled conditions in a single fracture in porous rock; and (3) to determine whether available lithologic, geochemical, and hydraulic properties together with existing or developed transport models are sufficient and appropriate to describe real field conditions (i.e. to scale from small-scale laboratory studies to bench-size studies to field studies). The detailed scope of this project and its current status are described. (9 refs.)

65378 Predicting Pu concentrations in solutions contacting geologic materials. R.G.Strickert, D.Rai (Pacific Northwest Lab., Richland, WA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.215-21

Knowledge of Pu solid phases present in nuclear wastes is important for predicting the geochemical behaviour of Pu. Thermodynamic data and experimental measurements using discrete Pu compounds, Pu-doped borosilicate glasses (simulating a high-level waste form), and Pu contaminated sediments suggest that $PuO_2(c)$ is very stable and is expected to be present in the repository. The solubility of the stable phase, such as $PuO_2(c)$, can be used to predict the maximum Pu concentration in solutions for long-term safety assessment of nuclear waste repositories. (11 refs.)

65379 Transient hydraulic tests in granite: fissured porous medium analysis and results. J.H.Black, J.A.Barker (Inst. of Geological Sci., Harwell Lab., Harwell, England).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.223-30

Slug and pulse tests have been used extensively to measure the hydraulic conductivity and specific storage of granitic rocks. After several hundred tests using an IGS design of straddle packer test equipment, it became clear that the conventional methods of test analysis were inadequate. The straddle packer equipment developed by IGS allows the time scale of a test to be altered without repositioning the packers so that a range of tests can be carried out on the same test interval. The new analysis procedure presented here uses a model of fissured rock which incorporates water movement in both the fissures and the rock matrix. A new variable is introduced which includes the parameters matrix hydraulic conductivity, matrix specific storage, fissure specific storage and fissure hydraulic conductivity together with the controllable variables, effective casing radius and packer interval length. Examples of analysis using multiple tests in the same interval are presented together with the apparent relationship between measured hydraulic conductivity and specific storage. It would appear that a small number of fissures endow the rock mass with the bulk of its hydraulic conductivity and that many of the higher hydraulic conductivity tests are probably associated with localised 'pipe flow'. (8 refs.)

65380 A natural analogue for storage of radwaste in crystalline rocks. D.G.Brookins, M.S.Abashian (Dept. of Geology, Univ. New Mexico, Albuquerque, NM, USA), L.H.Cohen, H.A.Wollenberg,Jr..

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.231-8

The Bryan-Eldora stock (Colorado) intruded the Precambrian Idaho Springs Formation metamorphic rocks 58 million years ago. Geochronologic-geochemical work by Hart et al. (1968) has demonstrated that the heat from the cooling intrusive rocks was sufficient to affect mineral isotopic systematics up to 2000 m from the contact, and the nature of these isotopic perturbations can be explained by a simple diffusion model in turn based on various heat flow models. The new studies are focussed on elemental exchange between stock and intruded rock as a function of distance from the contact; the assumption is made that the stock is a very large, high heat source analogous to a waste form emplaced in the metamorphic rocks without the benefit of canister or engineered backfill. Data for U, Th and the REE indicate actinide and lanthanide immobility except perhaps in the 0-2 m contact zone where some infiltration of the country rocks by stock-derived fluids occurred. Beyond 4 m no stock-derived U, Th, REE or *Pb are noted. Further, whole rock Rb-Sr and stable O isotopic data indicate conductive cooling as opposed to convective, water-induced cooling. The intruded rocks possess low porosity and permeability; this helped prevent elemental migration during the 10^5-10^6 years of stock crystallisation. The petrographic and geochemical studies show that the Idaho Springs (or equivalent) metamorphic rocks are well suited for radwaste storage. (7 refs.)

65381 Radionuclide migration: laboratory experiments with isolated fractures. R.S.Rundberg, J.L.Thompson, S.Maestas (Los Alamos Nat. Lab., Los Alamos, NM, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.239-48

Laboratory experiments examining flow and element migration in rocks containing isolated fractures have been initiated at the Los Alamos National Laboratory. Techniques are being developed to establish simple fracture flow systems which are appropriate to models using analytical solutions to the matrix diffusion-flow equations. These experiments are intended to be intermediate steps toward larger scale field experiments where it may become more difficult to establish and control the parameters important to nuclide migration in fractured media. Laboratory experiments have been run on fractures ranging in size from 1 to 20 cm in length. The hydraulic flow in these fractures was studied to provide the effective apertures. Traced solutions containing ^{85}Sr and ^{137}Cs were flowed through fractures in Climax Stock granite and welded tuff (Bullfrog and Tram members, Yucca Mountain, Nevada Test Site). The results of the elutions through granite agree with the matrix diffusion calculations based on independent measurements of K_d. The results of the elutions through tuff, however, agree only if the K_d values used in the calculations are lower than the K_d values measured using a batch technique. This trend has been previously observed in chromatographic column experiments with tuff. (6 refs.)

65382 Zirconolites from Sri Lanka, South Africa and Brazil. R.C.Ewing, R.F.Haaker (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA), T.J.Headley, P.F.Hlava.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.249-56

Zirconolites, $CaZrTi_2O_7$, from Sri Lanka and Pala Bora, South Africa, and a calzirtite, $CaZr_3TiO_9$, from Jacupiranga, Brazil, were examined using the electron microprobe, X-ray diffraction (annealing study), transmission electron microscopy, scanning electron microscopy and optical microscopy. The X-ray data indicate that all three zirconolites are metamict. Both Sri Lanka zirconolites are amorphous to the limits of resolution of the electron microscope ($\sim$10 A). The Pala Bora zirconolite is largely amorphous but contains isolated domains (50-200 A) of crystalline material which may be the result of post-metamict recrystallisation and alteration. The only other significant evidence for chemical alteration was the lower Th concentration (1-2 weight percent) and slightly lower analytic totals for the rims of the Sri Lanka zirconolites. Upon annealing at 1130°C for 5 hours, all three zirconolites recrystallised as microcrystalline aggregates. Both Sri Lanka zirconolites contain microvoids, spherical in shape, and 200 Angstroms to 2 microns in size. This porosity may be the result of helium accumulation arising from the decay of U and Th. The calzirtite was highly crystalline, exhibited no porosity, and was unchanged by the annealing treatment. (13 refs.)

65383 Study of polyhalite from the WIPP site, New Mexico. D.G.Brookins (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.257-64

Polyhalite ($K_2Ca_2Mg(SO_4).2H_2O$) is an important mineral present in the bedded evaporites of the WIPP site, southeastern New Mexico. Polyhalite contains two structurally bonded water molecules, and it is thus important to know if this mineral formed at or close to the time of sedimentation or more or less continuously throughout the Mesozoic and Cenozoic. If formed much later than original evaporite formation, then this implies a new source of water in order for polyhalite to form in turn raising questions about water abundance and mobility in the bedded evaporites. Polyhalite is not well suited for Rb-Sr geochronologic study because of the large amounts of common Sr, but it has been shown to be suitable for study by the K-Ar geochronologic methods. Pure polyhalites and those mixed with very small amounts of impurities yield K-Ar dates in the range of 200-220 MYBP and indicate little if any, loss of ^{*40}Ar. Polyhalites mixed with sylvite, halite, and (Na,K)Cl yield lower ages due to loss of ^{*40}Ar from the halides. Apparent are lowering is proportional to halide content and an extrapolated age of formation of near 225 MYBP results. Collectively, the K-Ar data convincingly show that the polyhalites formed at the time of sedimentation (except for isolated occurrences near dike intrusions) in Late Permian time. Finally, thermodynamic calculations, supported by petrographic study, show that polyhalite is often stable with respect to carnallite, sylvite and other minerals formerly thought to be older than polyhalite. (13 refs.)

65384 Uranium-lead radiometric age determinations of naturally occurring U(VI) minerals: application to radwaste storage. D.G.Brookins (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.265-71
U(VI) bearing species are commonly formed under oxidising laboratory rock-water-HLW experimental conditions. The experimental stability of artificially produced Na-Cs-Rb weeksite (alkali uranyl hydrosilicate), and other U(VI) species, is uncertain. Naturally occurring U(VI) bearing minerals (uranophane and tyuyamunite) from the Grants mineral belt, New Mexico, have been studied for their U-Pb systematics as natural analogues to these experimentally produced phases. Samples from highly oxidised rocks and from chemically reducing environments have been studied. The samples from oxidised rocks are mixed with hematite-barite-gypsum-calcite gangue and are close to, but not in contact with, pyritiferous-organic carbon-uraniferous (U(IV))-chloritic ore. The reduced rock uranophane yields nearly concordant ^{238}U-^{206}Pb and ^{234}U-^{207}Pb ages of 8.32 and 8.33 MYBP (millions of years before the present); the oxidised rock uranophane and tyuyamunite yield more discordant ages ($n=8$) between 7.4 and 2.7 MYBP. These data argue for long range stability of U(VI)-rich phases in the geologic environment. (12 refs.)

65385 Diffusion of neptunyl(V)- and pertechnetate ions in marine sediments. F.Schreiner, S.Fried, A.Friedman (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.273-7
The diffusion of the $^{235}NpO_2{}^+$ and $^{95m}TcO_4{}^-$-ions has been measured directly in sample cylinders of two different sediments from the floor of the deep sea. In smectite-rich sediment not shielded from contact with atmospheric oxygen the following values were obtained for the effective diffusion coefficients of neptunyl-and pertechnetate-ions, respectively: $D_{eff}(NpO_2{}^+)=1.5\times10^{-12}$ m^2 s^{-1} and $D_{eff}(TcO_4{}^-)=3.2\times10^{-10}$ m^2 s^{-1}. Under anoxic conditions in sediment with known reducing properties, the pertechnetate ion appears to undergo slow reduction and the effective diffusion coefficient of the reduced species of D_{eff}(Tc, red)$=1.1\times10^{14}$ m^2 s^{-1} reflects a substantial decrease of the mobility of the lower-valent technetium. (1 ref.)

65386 Radiogeological assessment of candidate sites for nuclear waste repositories, exemplified by studies of the Stripa Pluton, Sweden. H.A.Wollenberg, S.Flexser, L.Andersson (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.279-86
Investigation of candidate sites for nuclear waste isolation will require an assessment of their radiogeologic settings. Studies at the Stripa research facility in granitic rock of central Sweden incorporated the distribution and abundance of naturally occurring radioelements in rocks encompassing the underground experiments and in the accompanying fracture-controlled groundwater system. These studies showed that besides defining the natural radioactivity baseline upon which the effects of radioactive waste will be superimposed, radioelement distributions can be used to determine the apparent age of the groundwater and its flow paths. In crystalline rocks, where the groundwater systems are confined to the joints and fractures, the uranium daughter element, radon-222 in the water serves as a natural tracer to locate fractures along which significant flow is occurring and to measure the flow rates. The heat production from radioactive decay of uranium-238, thorium-232 and potassium-40 in the rock, combined with measurements of regional and local geothermal heat flow, permit calculation of the apparent size of the rock mass that will encompass the repository. This method is especially useful in terrains such as at Stripa where the contacts between plutons and older rocks are concealed. (6 refs.)

65387 Predictions of radionuclide migration rates for a subseabed repository. L.H.Brush (Seabed Programs Div., Sandia Nat. Labs., Albuquerque, NM, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.287-94
Geochemical research carried out by the US Subseabed Disposal Program is described. Data from studies of high temperature interactions between sediments and porewater (seawater), and of sorption and diffusion of radionuclides in oxidised, deep-sea sediments are used, along with results from heat transfer studies, to predict migration rates of radionuclides in a subseabed repository. Preliminary results for most radionuclides in oxidised sediments are very encouraging: fission products with moderate values of K_D (generally 10 to 10 ml/g), and actinides with high values of K_D (generally 10^3 to 10^6 ml/g) would not migrate significant distances before decaying to innocuous concentrations. ^{137}Cs, ^{90}Sr, and ^{239}Pu are among this group. The results for anionic species are less encouraging, but preliminary work with reduced sediments indicates that Tc can be effectively isolated. Planning for a field verification of these laboratory and modelling studies is also described. (27 refs.)

65388 Diffusion measurements in compacted bentonite. B.Torstenfelt, K.Andersson, H.Kipatsi, B.Allard, U.Olofsson (Dept. of Nuclear Chem., Chalmers Univ. of Technol., Goteborg, Sweden).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.295-302
The diffusion of Cs, Sr, Am and Tc in compacted bentonite clay has been studied, using a diffusion cell where diffusion takes place axially from the centre of a cylinder of the clay. The effect of addition of potential radionuclide getters to the clay (apatite for Am, pyrite, olivine, and Fe(s) for Tc) as well as using complexed (acetate) or colloidal Am has been studied. The diffusivities obtained for Cs and Sr were very high-9.0×10^{-13} m^2/s and 2.6×10^{-12} m^2/s, considering that if the effect of sorption on the clay is subtracted the diffusivities would be 1.8×10^{-9} m^2/s and 3.1×10^{-8} m^2/s. These diffusivities are, however, maximum values as the concentration profiles do not follow the theoretical form for these nuclides. A small amount of the ions seems to migrate very fast, while the rest moves slower. For Tc, that may be expected to be anionic and thus poorly sorbed, a diffusivity of 5.3×10^{-11} m^2/s was obtained. Addition of Fe(s) decreases the diffusivity by one order of magnitude while olivine and pyrite have no measurable influence during the present contact times (2-3 months). Americium is practically immobile. (12 refs.)

65389 Migration rates of brine inclusions in single crystals of NaCl. I-Ming Chou (US Geological Survey, Reston, VA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.303-10
Rock-salt deposits have been considered as a possible medium for the permanent storage of high-level radioactive wastes and spent fuel. Brine inclusions present in natural salt can migrate toward the waste if the temperature and the temperature gradients in the vicinity of the radioactive waste are large enough. This migration is due to the dissolution of salt at the hot side of the salt-brine interface, ion diffusion through the brine droplet, and the precipitation of salt at the cold side to the salt brine interface. In order to quantify the problem, the migration rate of these brine inclusions must be estimated under various repository conditions. The author estimates migration rates for all-liquid brine inclusions in single crystals of NaCl by utilising recent data for brines and the model of Anthony and Cline (1971). The predictions are compared with experimentally measured migration rates. (27 refs.)

65390 Corrosion of construction materials in clay environments. J.Dresselaers, F.Casteels, H.Tas (SCK/CEN Studiecentrum voor Kernenergie, Booretang, Belgium).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.311-19
The corrosion rate and mechanism of construction materials of galleries and casings for boreholes (possibly to be used as consumable overpack of HLW canisters) have been evaluated after a first campaign of corrosion experiments in direct contact with clay, in a humid clay atmosphere and in a gas corrosion chamber. The envisaged construction material is ductile iron (grade 60) and has been tested with and without metallic and organic coatings. The corrosion mechanism is governed by the formation of a rust scale composed of Fe_3O_4 and C. Preferential attack underneath the surface reaction layer is associated with the progress of a reaction front at the interface between the graphic nodules or flakes and the ferritic of pearlitic structure. Post-corrosion analyses of old gray iron coal mine shafts exposed for 60 and 90 years in well defined conditions are included to validate the use of the results of the short-time tests for very long exposure times. (5 refs.)

65391 The dissolution of irradiated fuel under hydrothermal conditions. L.H.Johnson, H.H.Joling (Whiteshell Nuclear Res. Establ., AECL, Pinawa, Manitoba, Canada).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.321-7
Uranium dioxide, the major component of irradiated CANDU fuel, shows good hydrothermal stability under the appropriate redox conditions. The thermodynamic stability of UO_2 in low ionic strength granite groundwater at 150°C under oxidising and reducing conditions is briefly reviewed in order to provide a basis for discussion of the results of irradiated fuel dissolution experiments. Fuel chemistry characteristics that influence the kinetics of fission product release are also discussed. Experimental studies demonstrate the influence of redox chemistry on irradiated fuel dissolution behaviour. Under strongly reducing conditions, both uranium and ^{99}Tc concentrations in solution decrease to the detection limit, whereas appreciable concentrations of both elements accumulate under oxidising conditions. The release of some fission products, such as ^{90}Sr and ^{137}Cs, does not seem to be strongly affected by changes in redox chemistry. Under oxidising conditions, the rate of ^{90}Sr release to solution increases by a factor of ten to twenty between 25 and 150°C. (13 refs.)

65392 Permeability, swelling and radionuclide retardation properties of candidate backfill materials. J.H.Westsik,Jr., L.A.Bray, F.N.Hodges, E.J.Wheelwright (Pacific Northwest Lab., Richland, WA, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.329-36
A backfill placed between a nuclear waste canister and the host geology of a nuclear waste repository can impede the migration of water through the waste package and retard the movement of radionuclides into the geologic formation. Hydraulic conductivities and swelling pressures are being determined as functions of the density of the compacted backfill, temperature, radiation dose, hydraulic head and the chemical composition of the permeating fluid. Bentonite clays and bentonite/sand mixtures have received initial emphasis. Sodium bentonite and calcium bentonite samples compacted to a dry density of 2.1 g/cm^3 had hydraulic conductivities in the range of 10^{-12} to 10^{-13} cm/s. In addition, batch distribution ratios (R_d) for Sr, Cs, Am, Np, I, U and Tc have been measured for a number of candidate backfill materials. Both initial permeability and sorption studies have used a synthetic basaltic ground water. (12 refs.)

65393 PNL-Sandia HLW package interactions test: phase one. M.A.Molecke (Sandia Nat. Labs., Albuquerque, NM, USA), D.J.Bradley, J.W.Shade.
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.337-45
The first phase of a complex high-level waste (HLW) package interactions test in a salt environment has been completed. The test system consisted of PNL 76-68 HLW glass (loaded with inactive fission products and ^{238}U) surrounded by a stainless steel waste canister, a TiCode-12 overpack, a bentonite/sand backfill, excess brine leachant, and a bedded rock salt container, all held within a 19-liter autoclave. All components were physically compromised in order to force wasteform-barrier-salt interactions to occur during this 95-day, 250°C overtest. Analyses of leachant, wasteform, and all barrier surfaces were performed. Test data included the synergistic effects between barriers and confirmed previous analyses of simpler systems. The glass wasteform exhibited some surface alteration but was not dissolved to any significant degree. The TiCode-12 overpack showed minimal uniform corrosion and no localized attack. Observed mineralogical alteration of the backfill was minimal. (8 refs.)

65394 Mechanisms of dissolution of radioactive waste storage glasses and caesium migration from a granite repository. N.A.Chapman, I.G.McKinley, D.Savage, J.M.West (Inst. of Geological Sci., Environmental Protection Unit, Harwell, England).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.347-54

Experimental and theoretical data are used to compare the effect of three possible leach mechanisms for borosilicate glass waste buried in a granite host-rock on the release and subsequent migration of ^{135}Cs. Protracted release episodes and variations of up to an order of magnitude in groundwater transport times and five orders in output concentrations are possible. (12 refs.)

65395 Degradation of rocks, through cracking caused by differential thermal expansion, in relation to nuclear waste repositories. J.R.McLaren, R.W.Davidge, I.Titchell (Materials Dev. Div., AERE Harwell, England), K.Sincock, A.Bromley.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.355-62

Heating to temperatures up to 500°C, gives a reduction in Young's modulus and increase in permeability of granitic rocks and it is likely that a major reason is grain boundary cracking. The cracking of grain boundary facets in polycrystalline multiphase materials showing anisotropic thermal expansion behaviour is controlled by several microstructural factors in addition to the intrinsic thermal and elastic properties. Of specific interest are the relative orientations of the two grains meeting at the facet, and the size of the facet; these factors thus introduce two statistical aspects to the problem and these are introduced to give quantitative data on crack density versus temperature. The theory is compared with experimental measurements of Young's modulus and permeability for various rocks as a function of temperature. There is good qualitative agreement, and the additional (mainly microstructural) data required for a quantitative comparison are defined. (8 refs.)

65396 Development of engineered structural barriers for nuclear waste packages. R.E.Westerman, S.G.Pitman, R.P.Elmore, J.L.Nelson (Pacific Northwest Lab., Richland, WA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.363-70

The development of structural barriers for nuclear waste packages involves selection of candidate materials, their screening by mechanical and corrosion testing, rigorous accelerated testing, and evaluation and comparison with other package elements. This document presents results from work conducted on titanium and cast steels. (6 refs.)

65397 Experimental and theoretical analyses of small-scale radionuclide migration field experiments. K.L.Erickson, D.R.Fortney (Sandia Nat. Labs., Albuquerque, NM, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.371-8

Analyses have been completed which provide guidance for conducting radionuclide migration field experiments. Characterization of nonwelded tuffs and laboratory experiments defining dominant chemical phenomena were used to develop a model for describing migration in fractured porous rock. Criteria for obtaining optimum experimental conditions were developed in terms of the key variables dominating migration in a given rock type, namely the fracture aperture, distribution coefficient, and average fluid velocity. For simple dissolved species, which are reversibly sorbed, variations in fracture aperture and fluid velocity affect experiment results much more than variations in distribution coefficient. Therefore, the experiment should be designed to optimize hydrogeologic conditions rather than sorption properties. (7 refs.)

65398 Reference laboratory testing for backfill. R.M.Chung, F.Y.Yokel (NBS, Washington, DC, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.379-87

Relatively high magnitude of swelling and low hydraulic conductivity are two of the performance requirements for the backfill placed around the radioactive waste package for the underground nuclear waste storage scheme. Some studies have been conducted in US national laboratories and in other countries where the candidate backfill materials were tested under many different conditions to determine the expected range of these properties. The authors briefly examine the variables that were found to be significant in the evaluation of swelling and hydraulic conductivity and special emphasis is placed on the compaction method, compaction effort, and the moisture content at the time of compaction, which do not receive much consideration in ongoing test programs. (11 refs.)

65399 Strontium-basalt reactions under nuclear waste repository conditions. S.Komarneni (Materials Res. Lab., Pennsylvania State Univ., University Park, PA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.389-95

Hydrothermal interactions of Sr as strontium chloride or hydroxide with basalts or basalt phases were investigated at 300°C for 4 and/or 12 weeks under a confining pressure of 30MPa. The nature and extent of Sr immobilization varied with the Sr source and with the basalt or basalt phase which immobilized up to 99.99% of the added Sr. The main mechanism of Sr fixation with basalts seems to be ion exchange when $SrCl_2$ was the Sr source. Among the basalt phases, basalt glass was the most effective for $SrCl_2$ immobilization by probably forming new strontium mineral phases. However, when $Sr(OH)_2$ reacted with basalts or basalt phases Sr was immobilized by the crystallization of strontium aluminosilicates such as $SrAl_2Si_2O_8$. These results of Sr-near-field interactions in a basalt repository indicate that basalt can be a good barrier for Sr migration from nuclear wastes. (11 refs.)

65400 Backfill-waste interactions in repository simulating tests. N.Sasaki (Tokai Works, Power Reactor & Nuclear Fuel Dev. Corp., Ibaraki-ken, Japan), S.Komarneni, B.E.Scheetz, R.Roy.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.397-404

Candidate backfill materials such as montmorillonite and clinoptilolite with and without the presence of simulated nuclear waste solids such as borosilicate glass, glass ceramic, sintered ceramic and supercalcine ceramic were investigated under repository stimulating conditions (=300°C and 30 MPa). Experiments were conducted under semi-wet as well as wet repository conditions. Reactions of backfill materials with simulated wastes and immobilized waste elements such as Cs, Mo, etc. form new phases such as analcime, oligoclase and powellite. In fact, analyses of product solutions from interaction runs indicated that the presence of backfill materials during the alteration of waste solids served to drastically reduce the concentration of some radionuclides in solutions. These results suggest that properly selected backfills can provide the simplest and most effective chemical (or thermodynamic) engineered barrier in an intelligently designed multibarrier system. (13 refs.)

65401 Alpha decay self-damage in cubic and monoclinic zirconolite. F.W.Clinard,Jr., C.C.Land, D.E.Peterson, D.L.Rohr, R.B.Roof (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.405-12

Samples of primarily-monoclinic ^{238}Pu-doped zirconolite were stored at ambient temperature to allow accumulation of alpha decay self-damage to a dose of 6×10^{24} α/m^3 (equivalent to a SYNROC age of $\sim10^3$y). Bulk swelling reached 2.3 vol% with no tendency toward saturation, a damage response similar to that observed for cubic Pu-doped zirconolite. X-ray volumetric swelling at 4×10^{24} α/m^3 was 1 vol%, considerably less than that for the cubic material. Changes in cell dimensions differed significantly from those reported by others for a monoclinic natural mineral. Extensive microcracking was observed, and is attributed at least partially to swelling differences between the matrix and minor phases. (16 refs.)

65402 Chemical, physical and engineering characterization of candidate backfill clays and clay admixtures for a nuclear waste respository. I. S.K.Singh (Materials Res. Lab. Ltd., Nepean, Ontario, Canada).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.413-32

Fourteen Canadian clays and clay admixtures were subjected to simulated nuclear waste repository environments. The present work is concerned with the montmorillonite-dominant materials only. The montmorillonite-dominant samples showed significant leaching on interaction with deionized water. On heating the samples at 200°C for 500 hours, montmorillonites lost intermicellar water completely and acquired cusp-like to cylindrical morphologies. The loss of water and the morphological changes in montmorillonites significantly altered the engineering characteristics. Permeability, shrinkage limits, compactability and shear strength varied in response to the dominant exchange cation in the structure of montmorillonites and the presence of other mineral components in the materials. The synthetic granite water reacted with montmorillonites and led to changes in chemical and mineralogical compositions, crystalline state and engineering properties. (1 ref.)

65403 Radiation induced sodium metal colloid formation in natural rock salt from different geological localities. J.M.Loman, P.W.Levy, K.J.Swyler (Brookhaven Nat. Lab., Upton, NY, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.433-40

Radiation damage has been studied in natural rock salt from various localities, including potential repository sites. In the 100 to 300°C range the damage consists of point defects, primarily F-centers, and colloidal metal sodium particles. With increasing dose the F-centres grow to a saturation level, reached at 10^7-10^8 rad, that decreases with increasing temperature to a negligible level at 300°C. Colloid concentration vs. irradiation-time curves follow nucleation and growth curves accurately described by $C\ t^n$, or $C(\mathrm{dose})^n$, relations at large irradiation times. For fourteen samples, $n=1.85\pm0.18$ but the values of C vary by a factor of more than 10^3. The constant C is related to the sample strain, the impurity and void content, dose rate, and possibly other factors. The currently available data indicate that rock salt adjacent to radioactive waste canisters, at a temperature of 150°C, will contain between 0.01 and 10 mole percent of sodium metal when the total dose reaches 10^{10} rad. (6 refs.)

65404 Novel experiments for understanding the shallow land burial of low-level radioactive wastes. G.L.DePoorter, T.E.Hakonson (Los Alamos Nat. Lab., Los Alamos, NM, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.441-7

Data on the basic processes that occur in the shallow land burial of low-level radioactive wastes are needed to engineer facilities with guaranteed performance, to validate models for system predictions, and to provide input to models that consider contaminant pathways out of the facility. Two types of novel experiments that will provide experimental data on the basic processes in shallow land burial facilities are described. Generic experiments that give data on the movement of water and radionuclides and an experiment that is particularly important for semi-arid sites are described. (13 refs.)

65405 Identification of possible high integrity containers for low-level nuclear waste disposal. J.D.Williams (Hittman Nuclear & Dev. Corp., Columbia, MD, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.449-55

Increased concern by the State of South Carolina over the condition and capacity of the low-level radioactive waste burial site at Barnwell has prompted them to promulgate new regulations on waste burial containers. As of September 30, 1981, ion exchange resin and filter media waste with an activity of 1 μCi/cc or greater and with isotopes with half-lives greater than five years disposed at Barnwell shall be solidified or confined in a 'high integrity container'. The materials and designs of these containers are required to provide waste isolation from the environment for a period of 300 years and provide the structural integrity specified in 49 CFR 173.398(b). HITTMAN has been active in the design and development of containers suitable for this purpose with this paper detailing the analyses involved. Material selections were limited to stainless steel, fiberglass, and polyethylenes. Structural concerns focused on overpressure requirements, drop-testing requirements, and lifting capabilities. With a lifetime dose. (7 refs.)

65406 Stochastic analysis of groundwater flow and contaminant transport in a fractured rock system. F.W.Schwartz, L.Smith, A.S.Crowe (Dept. of Geology, Univ. of Alberta, Edmonton, Alberta, Canada).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.457-63

It has been possible to develop a stochastic model for groundwater flow and mass transport in a fractured rock system. A large number of statistically independent realizations of a fracture network are generated from a set of probability distributions for parameters defining the fracture geometry. By solving for hydraulic head at the fracture intersections and using data on apertures and porosities, seepage velocities may be calculated and the transport equation solved for each trial of a Monte Carlo simulation. Model output consists of distributions of moving particles and various mass exit times. Applications illustrate the types of model results and the skewed character of particle distributions. (9 refs.)

65407 Solidification of radioactive wastes with thermosetting resin. M.Hayashi (Tokyo Electric Power Co., Tokyo, Japan), K.Kobayashi, O.Okamoto, T.Kagawa, K.Wakamatsu, H.Irie, H.Matsuura, K.Yasumura, Y.Nakayama.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.465-72

Dried simulated radioactive wastes were solidified with thermosetting resin and their properties were investigated with laboratory scale and real scale products through extensive testings, such as mechanical resistance, resistance to leaching and swelling in water, radiation resistance, fire resistance and resistance to temperature cycling. The typical results were as follows: over 600 kg/cm^2 of compressive strength, diffusion constant of $\sim 10^{-5}$ cm^2/day for ^{137}Cs leaching from solidified waste products, no significant change was found for up to 5×10^8 RAD irradiation, and damages were limited to the surface of the products after the thermal test and dropping impact test. (3 refs.)

65408 Nuclear waste disposal: the interface between performance assessment and research. R.B.Lyon (Whiteshell Nuclear Res. Establ., AECL, Pinawa, Manitoba, Canada).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.473-80

The potential impact of the post-closure phase of a nuclear fuel waste disposal project is radiation dose to man. Radiation dose is estimated as the end product of a total systems analysis. Field and laboratory research must be assimilated in a form that can be accepted by the total systems analysis procedure. A central focus of this assimilation must be the consideration of uncertainties in the analysis and data used. Irreducible uncertainty arises because of the wide variability in natural systems and the unprecedented extrapolation into the distant future. The SYVAC computer program provides a framework for assimilation of the results of the field and laboratory research with a systematic treatment of uncertainty. A SYVAC assessment of the post-closure performance of a Canadian nuclear waste disposal facility is presented with particular illustrations of the interface between the assessment models and data and the field and laboratory research. (17 refs.)

65409 Processing of titanates and zeolites and use of a cartridge system for 'reactor' wastes. S.Forberg, T.Westermark, K.Svardstrom, L.Falth (Dept. of Nuclear Chem., Royal Inst. of Technol., Stockholm, Sweden).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.481-8

New methods were introduced in order to facilitate the production of (i) very coarse-grain pure mordenite at a large scale (ii) mono-disperse sodium titanate of a low price also at small volumes, and (iii) a composite ion exchanger with up to 20 W-% of mordenite in beads of sodium titantate. Zeolites and titanates were converted to ceramic bodies by hot isostatic pressing at 1300°C or by cold pressing followed by sintering at temperatures up to 1300°C. Processed materials were zeolites, titanates and mixtures of them. The mechanical properties of sintered titanates were inferior to the hot pressed ones. Diffraction studies, static leaching at 40°C and Soxhlet leach tests were performed. The leach rates were much higher for mixed materials than for pure ones. For the handling of inorganic ion exchangers through all processes from packing of inactive beds and immobilization of radioactive species to the sintering or hot pressing for final disposal a system of cartridges is suggested. A lay-out of the system is presented together with some special arguments and some practical experiences. Simple, safe and hygienic operations with an optimal use of the inorganic sorbents are expected to result from this system. (13 refs.)

65410 Performance of asphalt and clay liners as a uranium mill tailings leachate barrier. J.Buelt, S.Barnes (Pacific Northwest Lab., Richland, WA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.489-96

Pacific Northwest Laboratory is evaluating the long-term effectiveness of various asphalt and clay liner materials as a radionuclide and process chemical barrier from uranium mill tailings. A field test is being conducted by monitoring asphalt and clay liners installed at the Grand Junction, Colorado tailings site. In addition eight prospective liners have undergone three months exposure to accelerated conditions to predict their behaviour over a 1000 year period. High calcium leachates have been forced through thin layers of clay to determine the ability of the clay to resist ion exchange, which reduces its swelling capabilities. Asphalt liners have been exposed to elevated temperatures and increased strengths of oxidising agents to acclerate their ageing process. The permeability coefficients measured during this exposure were then used to predict each liner's stability with time. The analyses thus far show that clay soils with bentonite amendments and most asphalt compositions have good long-term performance characteristics. (3 refs.)

65411 A comparative assessment of TRU waste forms and immobilisation processes. W.A.Ross, C.O.Harvey, R.O.Lokken, R.P.May, F.P.Roberts, C.L.Timmerman, R.L.Treat, J.H.Westsik,Jr. (Pacific Northwest Lab., Richland, WA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.497-504

Six alternative TRU waste forms and seven waste immobilisation processes are comparatively assessed on the basis of both product properties and process costs and risks. The waste forms are characterised for their leachability, mechanical strength, and thermal and radiation stability. The processes are evaluated in terms of costs (for processing, transportation, and repository disposal) and in terms of occupational exposure, industrial hazard, and quality assurance. Cast cement is recommended for immobilisation of defence TRU wastes. A glass system, either borosilicate or aluminosilicate, is recommended for immobilisation of commercial TRU wastes. (5 refs.)

65412 Low-level waste disposal analysis. D.Ensminger, C.Koplik, S.Oston, M.Kaplan, J.Nalbandian.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.505-12

The safety of low-level radioactive waste disposal sites is analysed using the computer code LOTRAN. Radiation doses to off-site individuals and to future land reclaimers are computed for a generic disposal site located in a humid Eastern environment. The predicted doses are compared to illustrative performance criteria developed under this project. Results provide insight into those characteristics of low-level waste disposal systems most important to public safety and will allow analyses of tradeoffs among natural and engineering features. (8 refs.)

65413 Leaching studies of radionuclides from solidifed wastes with thermosetting resin. K.Suzuki, H.Kuribayashi (JGC Corp., Yokohama, Japan), W.Morimitsu, I.Ono.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.513-18

The author reports on studies of the leachability of Co-60 and Cs-137 from simulated LWR radwastes solidified with thermosetting resin and evaluates the effects of chemical fixation on leachability. It is concluded that insolubilisation by a nickel-ferrocyanide compound offers an effective chemical fixation of these radionuclides and is a recommended pretreating method for radwastes that are to be solidified. (5 refs.)

65414 Biological intrusion of low-level waste trench covers. T.E.Hakonson, E.S.Gladney (Environmental Sci. Group, Los Alamos Nat. Lab., Los Alamos, NM, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.519-23

The long-term integrity of low-level waste shallow land burial sites is dependent on the interaction of physical, chemical, and biological factors that modify the waste containment system. Past research on low-level waste shallow land burial methods has emphasised physical (i.e. water infiltration, soil erosion) and chemical (radionuclide leaching) processes that can cause waste site failure and subsequent radionuclide transport. The authors demonstrate the need to consider biological processes as being potentially important in reducing the integrity of waste burial site cover treatments. Plants and animals not only can transport radionuclides to the ground surface via root systems and soil excavated from the cover profile by animal burrowing activities, but they modify physical and chemical processes within the cover profile by changing the water infiltration rates, soil erosion rates and chemical composition of the soil. One approach to limiting biological intrusion through the waste cover is to apply a barrier within the profile to limit root and animal penetration with depth. Experiments in the Los Alamos Experimental Engineering Test Facility were initiated to develop and evaluate biological barriers that are effective in minimising intrusion into waste trenches. The experiments that are described employ four different candidate barrier materials of geologic origin. Experimental variables that will be evaluated, in addition to barrier type, are barrier depth and soil overburden depth. The rate of biological intrusion through the various barrier materials is being evaluated through the use of activatable stable tracers. (12 refs.)

65415 Immobilisation and leakage of krypton encapsulated in zeolite or glass. A.B.Christensen, J.A.del Debbio, D.A.Knecht, J.E.Tanner (Exxon Nuclear Idaho Co., Idaho Falls, ID, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.525-32

Krypton and other gases are readily absorbed in zeolite 5A molecular sieve or porous Vycor 'thirsty glass' and may be trapped there by sintering 2-4 hours at 700° or 900°C, respectively. Encapsulation in these materials is the basis of a method to 'immobilise' krypton-85 for storage. Amounts of gas trapped are approximately proportional to gas density, and are about 50 and 40 cc (standard conditions=STP)/cc of solid at 1000 atm, for zeolite 5A and glass, respectively. Based on tests of a few months duration a leakage of 0.3% of the krypton is predicted for 10 years at 400°C for either material. (8 refs.)

65416 Iron-enriched basalt and its application to Three-Mile Island radioactive waste disposal. P.V.Kelsey,Jr., R.P.Schumann, J.M.Welch, D.E.Owen, J.E.Flinn (EG&G Idaho Inc., Idaho Falls, ID, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.533-40

Demonstration tests were performed on iron-enriched basalt (IEB), a dissolution and immobilisation medium for TMI radioactive wastes. Zeolite of the type used for cesium and strontium decontamination of TMI containment water was mixed with 20 wt% additives and melted at 1500°C to form IEB. Cesium volatility from the IEB melts was low. Leaching tests in 90°C deionised water showed leach rates of 6 $\mu g/cm^2.d$ for both cesium and strontium. IEB melts were used to dissolve Type 304 SS pellets and UO_2 pellets clad with zircaloy in order to simulate immobilisation of TMI core debris. Bubbling air through the melts greatly enhanced the dissolution of these components. (4 refs.)

65417 Hot-pressed barium sulphate ceramic waste forms for direct immobilisation of medium level Magnox waste. A.Briggs, D.V.C.Jones, G.B.Cole (Materials Dev. Div., AERE Harwell, Harwell, Didcot, England).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.541-8

A possible method of treatment for Magnox cladding waste is by dissolution in nitric acid and precipitation of barium sulphate-based floc with which radioactive ions are co-precipitated. The floc could then be immobilised in a matrix material such as cement or bitumen to give the waste form, or alternatively can be converted directly into a waste form by hot pressing. The authors describe the direct conversion of barium sulphate floc, containing simulated radwaste, into a synthetic, ceramic version of the natural mineral barite by a hot-pressing route. In going from the Magnox waste to the hot-pressed barium sulphate to a volume reduction factor ~ 18 is achieved. The principal phases in the product are found to be $BaSO_4$, MgO and Fe_3O_4, and the degree of consolidation achieved depends on the MgO content. The leaching behaviour of the hot-pressed materials depends on the MgO content, and on the consequent level of open porosity. (2 refs.)

65418 Migration of radionuclide chains in subseabed disposal. A.K.Ray, H.E.Nuttall (Dept. of Chem. Engng., Univ. of Kentucky, Lexington, KY, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.549-56

The authors study subseabed disposal; the two-dimensional (axial and radial) migration of radionuclide chains released from a canister located in a sedimentary layer bounded at the top by the ocean and at the bottom by an impermeable basalt zone is analysed to determine the escape rate of radionuclides into the seawater. Analytical solutions have been derived to represent the transient concentration profiles within the sediment, flux and discharge rates to the water column of each member present in a decay chain. Using the properties of chain members present in actinide decay systems, the effects of half-life, adsorption equilibrium and other relevant parameters are elucidated. (9 refs.)

65419 Rheological characterisation of cementitious grouts used to dispose of intermediate-level radioactive waste by hydrofracturing at Oak Ridge National Laboratory. E.W.Mcdaniel, J.G.Moore (Chem. Technol. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.557-65

The hydrofracturing process is a waste disposal process in use at the Oak Ridge National Laboratory for the permanent disposal of locally generated waste solutions. This process is now being modified for use in the disposal of sludge that results from the sodium hydroxide neutralisation of acid waste solutions. In this process, the sludges will be slurried in a bentonite clay suspension and mixed with a solids blend of cement and other additives. The amount of dry solids required for each litre of waste slurry will be determined from a rheogram that relates the viscosity of the slurry with the grams per litre recommended for grouts with desirable flow properties. A description of the process and the development of rheograms are included. Data are presented on the use of chemical additives to control the flow properties of grouts. (8 refs.)

65420 Formulation and processing of polyphase ceramics for high level nuclear waste. A.B.Harker, P.E.D.Morgan, D.R.Clarke, J.F.Flintoff (Rockwell Internat. Sci. Centre, Thousand Oaks, CA, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.567-73

Two basic crystalline phase assemblages have been developed for incorporating the full range of Savannah River Plant waste compositions into polyphase ceramic forms. Both phase assemblages provide crystalline host phases, with stable mineral analogues, for all radionuclides in the waste. The first, an alumina based assemblage, immobilises the radioactive elements in solid solutions of magnetoplumbite and uraninite with the bulk non-radioactive waste elements being present in spinel and nepheline. The second assemblages uses the titanate based 'zirconolite' type fluorite structure and the alumina/iron based magnetoplumbite phases to host the radioactive nuclei with spinel and nepheline, again providing crystalline hosts for the non-radioactive elements. Both phase assemblages can be consolidated to a fine grain ceramic by hot isostatic pressing at 1040°C pressures from 20000 to 30000 psi. Redox control during processing, just sufficient to reduce uranium to the tetravalent state, is used. (10 refs.)

65421 On-line measurements of the volatilisation of ruthenium in a vitrification process. R.Odoj, M.Schwitz (Inst. for Chem. Technol., KFA Julich, Julich, Germany).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.575-83

The studies were performed using Ru-103 as a tracer. The volatilisation of Ru from ruthenium containing liquids, like HAW-solutions, is about 15%. A chemical denitration of these solutions with HCHO or HCOOH reduces the volatilisation to about 2%. Additional catalytic reduction with Fe-powder lowers the volatilisation to about 4%. The carry over of Ru seems to depend on the aerosol production rate and not the vapour pressure. Only RuO_2 could be detected in the off-gas. (4 refs.)

65422 Cementitious radioactive waste hosts formed under elevated temperatures and pressures (FUETAP concretes). L.R.Dole, J.G.Moore, G.C.Rogers, G.A.West, H.E.Devaney, M.T.Morgan, E.W.McDaniel, J.H.Kessler (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.585-93

Concretes formed under elevated temperatures and pressures (FUETAP concretes) are effective hosts for transuranic (TRU) and high-level defence and commercial wastes. Tailored cement formulations developed at Oak Ridge National Laboratory (ORNL) use Portland cement, fly ash, sand, and clay additives. These FUETAP concretes are cured under mild autoclave conditions, then the unbound water is removed. The authors summarise the FUETAP development program. These continuous studies address the major questions concerning the performance of radioactive waste forms. (15 refs.)

65423 Behaviour of radionuclides during the smelting of noncombustible solid wastes. M.Osaki, S.Yokoi (Daido Steel Co. Ltd., Nagoya, Japan), M.Miyagawa.

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.595-602

The melting process of noncombustible solid wastes seems to be one of the most promising processes for volume reduction and immobilisation. This melting process needs a high temperature of around 1500°C, but the behaviour of radionuclides in such a process and at such a temperature has not been fully examined. The authors melted small contaminated samples to examine the behaviour of radionuclides. Melted products were subjected to leaching tests. Many assorted samples were melted, and it was found that the vapour pressure of the radionuclide determined the distribution between melted products and dusts. The standard free energy of oxide formation and the quantity of stable nuclide of the radionuclide determined the distribution between metal and slag products. The leaching rate of melted products was sufficiently low. (no refs.)

65424 Vitrification of high-level radioactive waste in a small-scale joule-heated ceramic melter. G.B.Woolsey, M.J.Plodinec (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.603-8

Vitrification is the reference process for the immobilisation of radioactive waste from the production of defence materials at the Savannah River Plant (SRP). Since 1979, a small vitrification facility (1 lb/hr) has been operated at the Savannah River Laboratory using SRP waste. In previous studies, dried waste was fed to this smaller melter. The authors discuss direct feeding of actual liquid-waste slurries to the small melter. These liquid-feeding tests demonstrated that addition of premelted glass frit to the waste slurry reduces the amount of material volatilised. Results of these tests are in accord with results of large-scale tests with actual waste. (6 refs.)

65425 Metastable liquid immiscibility in nuclear-waste-glasses. J.E.Engell, G.Roed (Inst. of Mineral Industry, Tech. Univ. of Denmark, Lyngby, Denmark).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.609-16

For glass systems related to two potential nuclear-waste-glasses, ABS-39 and ABS-41, the 600°C isotherm of the metastable immiscibility field has been located experimentally. Both glasses are in the one phase glass field down to temperatures below 600°C. ABS-39 and ABS-41 are Na_2O-B_2O_3-SiO_2 glasses containing 1.66 wt% UO_2 and 9 wt% of simulated fission products. Additional components in ABS-39 are Al_2O_3 and Fe_2O_3. In ABS-41 these two oxides are partly substituted with ZnO and Li_2O. This substitution causes and extension of the metastable immiscibility field relative to the ABS-39 system. (10 refs.)

65426 Mercury reduction and removal during high-level radioactive waste processing and vitrification. R.E.Eibling, J.R.Fowler (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.617-22

A reference process for immobilising the high-level radioactive waste in borosilicate glass has been developed at the Savannah River Plant. This waste contains a substantial amount of mercury from separations processing. Because mercury will not remain in borosilicate glass at the processing temperature, mercury must be removed before vitrification or must be handled in the off-gas system. A process has been developed to remove mercury by reduction with formic acid prior to vitrification. Additional benefits of formic acid treatment include improved sludge handling and glass melter redox control. (1 ref.)

65427 Interim waste forms for high-level radioactive wastes: processing and properties. G.Bandyopadhyay (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.623-31

Several simulated interim waste forms have been investigated in the laboratory to study their suitability for application in handling and transportation of high-level radioactive wastes to terminal processing sites. The author discusses the fused-salt/sludge option and the silicate-based option. The results from tests on simulated fused-salt waste forms indicated that the process simplicity of this option is partially offset by the high water solubility and hygroscopicity of the product, which would necessitate special precautions during transportation and storage. The most promising silicate-based option is the ambient-temperature silicate/sludge process, in which the sludge is mixed with sodium silicate [and sometimes with $Ca(OH)_2$] and subsequently exposed to a controlled-humidity environment at room temperature to form a chemical bond. Solid material containing 75 wt.% synthetic calcined sludge, prepared by this process, has sufficient physical, chemical, and mechanical stability for use as an interim waste form. (7 refs.)

65428 Tailored ion exchange resins for combined cesium and strontium removal from soluble SRP high-level waste. M.A.Ebra, R.M.Wallace, D.D.Walker, R.A.Wille (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).

Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.633-40

Novel organic resins that achieve high selectivities for both medium and strontium have been synthesized. They are condensation polymers of resorcinol and formaldehyde with attached chelating groups. Their column performance compares favorably with that of commercially available resins for either cesium or strontium removal. By combining Cs^+ and Sr^{2+} removal in the same bed, these resins can significantly reduce the size and complexity of proposed facilities for processing defense high-level waste. (5 refs.)

6429 **Application of ion beam techniques to the study of glass durability: enhanced dissolution in saline and radiation effects (radioactive waste).** C.Burman, Wang Ke-Ming, W.A.Lanford (Dept. of Phys., State Univ. of New York, Albany, NY, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible]

6430 **Leaching behavior of ion-implanted simulated HLW glasses and [illegible] prediction of their alpha-recoil aging.** [illegible]
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible]

6431 **The effect of radiolysis on leachability of plutonium and americium from 76-101 glass (radioactive waste).** [illegible] N.Sasak, P.Rickert, J.C.Sullivan, D.P.Karim, D.J.Lam (Chem. & Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
The authors have investigated the leaching of plutonium and americium from 76-101 glass samples (containing 2 mole% plutonium) in the presence of a [illegible] a factor of five. Speciation studies of the plutonium in the leachate indicate [illegible] leached in the radiation field. (6 refs.)

6432 **Ion implantation studies of nuclear waste forms.** [illegible]
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible]

6433 **Effect of alpha, gamma, and alpha-recoil radiation on borosilicate glass containing Savannah River Plant defense high-level nuclear waste.** N.E.Bibler (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible]

6434 **Study of the metamict transformation in [illegible]-quartz using high-resolution electron microscopy and convergent beam electron diffraction (nuclear waste).** [illegible]
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
The metamict transformation under electron irradiation has been studied in [illegible]-quartz using transmission electron microscopy (TEM) and convergent-beam electron diffraction (CBD). The transformation occurs in two stages: heterogeneous nucleation of discrete disordered inclusions and a slower [illegible]

[illegible]

6435 **Radiation effects in nuclear waste glasses.** J.F.DeNatale, D.K.McElfresh, D.G.Howitt (Dept. of Mech. Engng., Univ. of California, [illegible]).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
The radiation damage of a nuclear waste glass is shown to be associated with [illegible] and, when the glass is exposed to air saturated water, enhanced leaching. (2 refs.)

6436 **Influence of irradiation with gamma-quanta and beam of accelerated electrons on the sorption parameters of clay minerals of the montmorillonite group (radioactive waste).** [illegible]
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible] unchanged, while aluminosilicate layers converge which results in a decrease in interplane distance. (9 refs.)

6437 **Point defects and microstructural stability of glasses under irradiation.** M.Antonini (GNSM, Istituto di Fisica, Univ. di Modena, Modena, Italy), S.A.Buckley, P.Camagni, P.N.Gibson, A.Manara.
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible]

6438 **Radiation effects in radwaste glasses: a reappraisal of alpha-recoil aging as simulated by ion implantation.** J.C.Dran, Y.Langevin, M.Maurette, [illegible]
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible] consequently this technique is shown to be a valuable tool for the study of α-recoil aging in HLW glasses. (15 refs.)

6439 **The influence of gamma irradiation on the leaching behavior of a modified SYNROC-B ceramic waste form.** A.G.Solomah (School of Engng., [illegible]).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
[illegible] were observed with γ-irradiation than without irradiation. The results of the [illegible]

6440 **Management of radioactive wastes in Europe (EC history, philosophy and plans for the next five years).** S.Orlowski, R.A.Simon (Comm. of the European Communities, Brussels, Belgium).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.735-9
Since its first R&D programme on radioactive waste management in 1975, the [illegible]

6441 **Materials research in the Canadian nuclear fuel waste management program.** [illegible]
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.741-5
Nuclear fuel waste disposal research in Canada is concentrating on hard-rock disposal. The research programs concerned with the man-made components of

the disposal system are reviewed. Irradiated fuel and solidified reprocessing wastes are both being researched, as are durable containers, and buffer and backfill materials. This review concentrates mainly on the more scientific aspects of the research, which contribute to the selection of preferred options for the various components of the system, and which support directly or indirectly the safety analysis of the disposal concept. Some technology development is included in the program now, and this is expected to expand as confidence in the acceptability of the disposal concept grows. (45 refs.)

65442 Nuclear Regulatory Commission activities related to high-level waste materials issues. F.R.Cook (Div. of Waste Management, Nuclear Regulatory Comm., Washington, DC, USA).
Scientific Basis for Nuclear Waste Management. Proceedings of the Fourth International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, MA, USA, 16-19 Nov. 1981 (New York, USA: North-Holland 1982), p.[illegible]
Describes the materials related activities of the Nuclear Regulatory Commission's (NRC's) staff in the area of high-level waste licensing of a geologic repository for nuclear waste. It frames these activities in the context of existing draft regulations for high-level waste disposal. (no refs.)

65443 Effects of waste composition and loading on the chemical durability of a borosilicate glass. D.E.Clark, C.A.Maurer, A.R.Jurgensen, L.Urwongse (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.1-13
The effects of waste composition and percent loading in a borosilicate glass designed for US defense high level wastes (HLW) have been evaluated. Three types of simulated wastes were investigated: high alumina, high iron and a composite representative of an average waste composition from Savannah River Plant (SRP) waste tanks. Corrosion resistance of the borosilicate glass is significantly enhanced by the presence of any of the three types of wastes. Additionally, corrosion resistance is improved as the % waste loading is increased in the glass. The best corrosion performance was obtained with the high alumina waste in deionized water. (12 refs.)

65444 Chemical durability of glass containing SRP waste—leachability characteristics, protective layer formation, and repository system interactions. G.G.Wicks, B.M.Robnett, W.D.Rankin (Savannah River Lab., E.I. du Pont de Nemours & Co., Aiken, SC, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.15-24
Gives properties and characteristics of glass containing nuclear waste from the Savannah River Plant. (4 refs.)

65445 The mechanisms for hydrothermal leaching of nuclear waste glasses: properties and evaluation of surface layers. G.Malow (Hahn-Meitner-Inst., KFA Berlin GmbH, Berlin, Germany).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.25-36
Remobilization of solidified high-level waste by corrosion and transport of radionuclides by groundwater are the only likely events for radioactivity to find its way back to the environment. The interaction of the waste form with aqueous solutions is the most important mechanism and must be known for safety and risk analysis. It has been shown that the activity release depends on a number of experimental and environmental parameters. The corrosion mechanisms of the waste forms control the leach rate of individual components. Of particular importance is the resistance against water attack of various glass compositions and the formation of layers on the glass surface. The results for leaching in deionized water revealed that the mechanism was strongly influenced by the formation of a surface layer which determined the further attack on the glass. In the present work the specific weight losses of the glass after leaching in rock salt and $MgCl_2$–$MgSO_4$–NaCl–KCl solutions were measured and surface layers investigated. (5 refs.)

65446 Stability and alteration of naturally occurring low-silica glasses: implications for the long term stability of waste form glasses. C.C.Allen (Dept. of Geology, Univ. of New Mexico, Albuquerque, NM, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.37-44
Volcanic glass of basaltic composition (approximately 50 wt.% SiO_2) was studied as a natural analogue to proposed nuclear waste form glasses. Basaltic glass can resist devitrification and remain glassy for periods in excess of 10 m.y. Surface alteration of the glass occurs rapidly upon exposure to water or hydrothermal fluids, but is essentially absent if the glass remains dry. Alteration is restricted to a rind of clay-like, cryptocrystalline palagonite, generally less than 100 μm thick. Formation of this rind protects the underlying glass from further alteration. Similar rinds, or gel layers, have been produced in laboratory and field tests with borosilicate glasses. Major cations within the basaltic glass are selectively depleted or enriched relative to the glass in the alteration rind. Qualitatively-similar depletion and enrichment patterns characterize the short-term leaching behavior of candidate waste form glasses. (10 refs.)

65447 Long-term radioactivity release from solidified high-level waste. I. An approach to evaluating experimental data. F.K.Altenhein, W.Lutze (Hahn-Meitner-Inst., KFA Berlin GmbH, Berlin, Germany), R.C.Ewing.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.45-56
Safety and risk analyses for the isolation of radioactive waste in a repository must begin with a source term to quantify the amount of radioactivity released from the waste form under a specific set of conditions. The interaction of the waste form with aqueous solutions is the most important mechanism to consider, as any material released may be dissolved and reach the biosphere. In this regard the behaviour of heat generating high-level waste is of particular importance, because reaction rates are higher at elevated temperatures. A long-term leach rate was derived from previous and continuing experimental work. The authors do not describe the 'real case' release but provide guidelines for the design of leaching experiments and determine the required precision for the data. This can be derived from the relative sensitivity of extrapolated leach rates for various parameters measured in laboratory experiments. (14 refs.)

65448 A flow model for the kinetics of dissolution of nuclear waste forms: a comparison of borosilicate glass, Synroc and high-silica glass. P.B.Macedo, A.Barkatt, J.H.Simmons (Vitreous State Lab., Catholic Univ. of America, Washington, DC, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.57-69
A model has been developed to predict the long-term leach or release rates of various waste-form materials under repository conditions. (20 refs.)

65449 Waste glass repository interactions. D.E.Clark, C.A.Maurer (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.71-82
The effects of repository material and a tailored backfill or overpack on the leaching behavior of glass have been studied. Two types of glasses were used in this investigation: (1) model glasses comprised of 33 mol.% alkali oxide-67 mol.% SiO_2, and (2) alkali borosilicate glasses with and without simulated wastes. Several types of repository material were placed in the same containers as the glasses to determine if their presence would alter the extent of leaching. A backfill material consisting of phosphate slime/sand mixtures was evaluated with the same procedure. The results indicate that the leaching behavior of the glass may be influenced by the presence of some materials. Preliminary results of a 16½ month burial experiment in Florida are also discussed. (14 refs.)

65450 Leaching of vitrified high-level radioactive waste. A.R.Hall, A.Hough, J.A.C.Marples (Chem. Div., AERE, Harwell, Didcot, England).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.83-92
This is part of a study of the leaching of individual elements from waste glasses. The first part reports on leaching of the major constituents at 30°C, and leaching of the alkalis at 20°C from glass UK189; the second part describes leaching of Sr, Cs, Tc and various actinides from glasses UK189 and UK209. (1 ref.)

65451 The role of metal ion solubility in leaching of nuclear waste glasses. B.Grambow (Pacific Northwest Lab., Richland, WA, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.93-102
Since multicomponent waste glasses are unstable with respect to an assemblage of alteration products, thermodynamic equilibrium between the glass phase and the leaching solution can never be achieved. The author shows that the alteration phases resulting from the leaching of the waste glass ultimately regulate the solution concentrations as if equilibria with metal hydroxides or carbonates are established. (14 refs.)

65452 Relationship between glass leaching mechanism and geochemical transport of radionuclides. A.Avogadro, F.Lanza (Joint Res. Centre, Ispra Establ., Comm. of the European Communities, Ispra, Italy).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.103-12
An attempt has been made to subdivide the different elements present in the vitrified waste into classes in order to simplify the description of the release of the radio elements in the various repository conditions. (11 refs.)

65453 Leaching of actinides from simulated nuclear waste glass. S.Pickering, C.T.Walker (Joint Res. Centre, Karlsruhe Establ., Comm. of the European Communities, Karlsruhe, Germany), P.Offermann.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.113-24
The authors measured the resistance of simulated nuclear waste glasses to leaching by water and salt solution under the conditions of elevated temperature and pressure. Of particular interest was the behaviour of Am and Np. (10 refs.)

65454 Influence of a backfilling material on borosilicate glass leaching. F.Lanza, C.Ronsecco (Joint Res. Centre, Ispra Establ., Comm. of the European Communities, Ispra, Italy).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.125-33
The choice of backfilling material around a canister of waste-containing borosilicate glass is normally made on thermal conductivity grounds but it also affects the contact of water on the canister. If large amounts of water are in contact, the canister corrodes quicker and thus the glass is exposed to leaching quicker. (6 refs.)

65455 Effect of overpack materials on glass leaching in geological burial. L.Werme (SKBF Div. KBS, Stockholm, Sweden), L.L.Hench, A.Lodding.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.135-44
Discusses the findings in an in situ-burial experiment, presently being performed in the Stripa mine in Sweden. The purpose of the experiment is to evaluate the effects of various components in the SKBF/KBS waste storage system on the leaching of the vitreous waste form. Two configurations of glass, canister, overpack and buffer/backfill materials were designed. Both configurations were inserted into 56 mm diameter boreholes in the Stripa mine and maintained at 90°C. One of the configurations was also kept at ambient temperature, 9°C. In the experiments two glass types were used, ABS 39 and ABS 41. These glasses, developed by Dr. T. Lakatos of the Swedish Glass Research Institute, contain 9% simulated fission products by weight and are compatible with the French AVM process. (11 refs.)

65456 The interaction of borosilicate glass and granodiorite at 100°C, 50 MPa: implications for models of radionuclide release. D.Savage, J.E.Robbins (Harwell Lab., Inst. of Geological Sci., Harwell, England).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.145-52
An essential component of any assessment of HLRW geological disposal options is the quantitative prediction of radionuclide release rates from the near-field over time spans of the order of 10^3-10^6 years. Fundamental to this assessment is the investigation of the interaction of potential wasteforms with groundwater under repository conditions of temperature, pressure, and groundwater flow-rate. Therefore it was the intention of this study to examine the interaction of a typical wasteform (borosilicate glass) and a potential repository host rock (granodiorite) under near-field conditions of temperature, pressure and water flow-rate appropriate to the early (0-600 years), high temperature life of a repository, and to study the effects of saturation of waste components in the fluid phase on rates of radionuclide release. (10 refs.)

65457 Burial effects on nuclear waste glass. L.L.Hench (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA), L.Werme, A.Lodding.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.153-62
The purpose of this experiment was to evaluate the effects of various components of the SKBF/KBS nuclear waste storage system on the leaching of the vitreous waste form. Two configurations of nuclear waste glasses, canisters, overpacks, and backfill material were inserted into 5.6 cm×3 m deep boreholes located at the 350 m level in the STRIPA mine. Some were maintained at 90°C. The others were allowed to equilibrate at the ambient temperature of the mine, approximately 8°C. Two borosilicate nuclear waste glass compositions (termed ABS 39 and ABS 41) compatible with the French AVM process containing 9 percent by weight of simulated fission products were compared. The two compositions bracket the range of $SiO_2/Na_2O/B_2O_3$ ratios likely to be selected for commercial vitrification operations at La Hague. (9 refs.)

65458 The chemical durability of some HLW glasses: effects of hydrothermal conditions and ionising radiation. D.R.Cousens, R.A.Lewis, S.Myhra, R.L.Segall, R.St.C.Smart, P.S.Turner (School of Sci., Griffith Univ., Nathan, Queensland, Australia).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.163-71
The time dependence of leaching and dissolution under hydrothermal conditions at 250°C has been investigated in an autoclave designed for continuous sampling; it is found that the rates are in accord with those obtained by the commonly used procedures. The effect of pressure by itself has been studied in an ultracentrifuge; ambient rates for Si and Na loss remain unchanged up to about 40 MPa followed by a monotonic increase to about 1.5 times the ambient rates at 160 MPa. The surface layers formed as a result of chemical attack have been examined (XRD, IR, XPS and PIXE). It is found that Zn present in the glass or in the solution is retained in the siliceous layer which in some circumstances contains a crystalline zinc-hydroxy-silicate phase. A method for enhancing rates of displacement damage by a factor of $\sim 10^6$ has been developed. Powdered borosilicate glass and glass doped with UO_2 have been neutron-irradiated in a high-flux reactor. Irradiation doses equivalent to 10^6 years HLW storage have been achieved. The resultant stored energy of $\sim 10^2$ kJ kg^{-1} is released over the range 300 to 800K. The initial leaching/dissolution rates are found to be increased by a factor of about three by irradiation. (9 refs.)

65459 Determination of the corrosion mechanisms of high-level waste containing glass. H.Scholze, R.Conradt, H.Engelke, H.Roggendorf (Fraunhofer-Inst. fur Silicatforschung, Wurzburg, Germany).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.173-80
The German concept of high level waste final storage provides the use of certain glasses containing radioelement oxides as glass components. These waste forms are to be stored in rock salt formations in order to isolate the waste from the biosphere. The efficiency of this isolation is a most important question. The aim is to achieve a high safety standard that remains valid under extreme conditions such as the uncontrolled water entrance to the deposit. Investigations were carried out with two model glasses doped with inactive waste. Glass 1 relates to a waste glass developed from the glass ceramics C31 3EC, glass 2 is a borosilicate glass. (5 refs.)

65460 Results from a one-year leach test: long-term use of MCC-1. D.M.Strachan (Pacific Northwest Lab., Richland, WA, USA).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.181-91
Presents results from the long-term use of the MFF-1P Static Leach Test Method which has already been used for short-term testing and for comparing waste forms. Data were obtained on the leaching behavior of PNL 76-68 glass over a 1-year period. Complete solution analyses coupled with selected solid state analyses gave further insights into the mechanism of leaching for this glass and show that the MCC-1P test method can be used for periods up to at least 1 year. (12 refs.)

65461 Utilization of charged particle backscattering to study the near surface region of glasses. Application to depth profiling of lanthanium, cerium, thorium and uranium induced by aqueous leaching. P.Trocellier, B.Nens, C.Engelmann (Dept. de Chimie Appl. et d'Etudes Analytiques, CENS, Gif-sur-Yvette, France).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.193-202
The Rutherford backscattering technique is useful for the determination of the concentration profiles of some heavy elements in the near surface region of glasses, but is not able to provide chemical information on the elements detected. Nevertheless, it permits a non-destructive exploration of the surfaces of solids, and enables the actinides: Np, Pu, Am, ... to be detected. Relatively simple glasses containing either lanthanum and uranium or cerium and thorium were made, leached and finally examined to specify on one hand the analytical possibilities of the process, on the other hand the experimental conditions required to prevent secondary effects during sample bombardment. (2 refs.)

65462 On the leaching behaviour of a simple borosilicate glass in a confined environment. J.C.Petit, Y.Langevin, J.M.Lameille, J.C.Dran (Lab. Rene Bernas, Orsay, France).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.203-10
Cm-sized blocks of a simple borosilicate glass have been leached in hydrothermal conditions with various rates of water renewal. Weight loss measurements reveal that restricted water access does not slow down the dissolution rate of this particular glass as would be expected from solubility limits, but instead accelerates its destruction and its transformation into a secondary solid phase still ill-defined. (12 refs.)

65463 Comparative study of seven glasses for solidification of nuclear wastes. J.L.Nogues (Lab. des Verres, Univ. des Sci. et Tech. du Languedoc, Montpellier, France), L.L.Hench, J.Zarzycki.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.211-18
The relative leaching behavior of seven alkali borosilicate glasses considered for immobilization of high level radioactive wastes was compared using a static 90°C leach test similar to MCC-1. All compositions were compatible with the low melting temperature, 1150°C, viscosity and other process variables required for the French AVM process. The quantity of simulated waste products was from 10.9-15.9 weight %. (4 refs.)

65464 Chemical stability of simulated HLW forms in contact with clay media. P.Van Iseghem, W.Timmermans (Materials Sci. Dept., CEN, Mol, Belgium), R.de Batist.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.219-27
The corrosion stability of six simulated HLW forms proposed by several European countries (five borosilicate glasses and one borosilicate glass ceramic) in contact with different media relating to the clay disposal has been investigated for periods up to 80 days and at a surface area to solution volume ratio of 1 cm^{-1} under non de-aerated conditions. In the reference medium distilled water the corrosion stabilities are largely determined by saturation effects for elements such as Si, Ca, Mg, Sr, Fe and U. Si saturation is found to be enhanced by a large Al_2O_3 concentration in the glass. In the clay-water mixture these saturation effects are much less predominant. Wet clay attacks the waste forms faster than the clay-water mixture, although the corrosion rates tend to decrease with time in both clay media. In general, no simple Arrhenius-type temperature dependence for the corrosion behaviour is found for the interval between 40 and 200°C. (10 refs.)

65465 INTRACOIN—an international nuclide transport code intercomparison study. K.Andersson (Swedish Nuclear Power Inspectorate, Stockholm, Sweden), B.Grundfelt, J.Hadermann.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.839-47
To improve the understanding of various strategies for geospheric radionuclide transport modelling an international cooperation project with ten participating organisations has been set up. In the project—INTRACOIN (International Nuclide Transport Code Intercomparison) study—a comparison between models is made on three levels with increasing complexity. Calculations are performed with some 20 computer codes representing different modelling strategies. The INTRACOIN study is limited in its scope to far-field radionuclide geosphere transport models. Thus, near-field models, groundwater hydraulics and models for transport in the biosphere are not included. However, since the geological barrier is an important part of the safety system the study should contribute to the understanding of important phenomena related to long-term safety assessments. In addition it provides a forum for discussion and for direct exchange of experience between experts in the field. (2 refs.)

65466 In-situ solidification of low and medium level wastes. R.Kraemer, R.Kroebel (Projekt Wiederaufarbeitung und Abfallbehandlung, Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.849-58
Since 1976, a German R&D project has been carried out to find an alternative concept for the treatment and disposal of MLW and LLW arisings generated mainly in the planned German reprocessing plant and other nuclear facilities. The main feature of this concept is an in-situ solidification of preconditioned waste granules in large salt caverns located in the deep geological underground. The authors describe an experimental demonstration of relevant components on a semi-industrial, non-radioactive scale. (5 refs.)

65467 Computations of temperature profiles in the medium/low-level waste cement and in the rock salt surrounding the disposal cavern. W.Hauser, E.Smailos, R.Koster (Inst. fur Nukleare Entsorgungstech, Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.859-66
In the investigations discussed, a three-dimensional computer program was employed using experimentally determined data on the heat generation of the granule/grout product. This made it possible to calculate temperature profiles in the waste product as well as in the surrounding rock salt. (3 refs.)

65468 Granules, a new waste form for in-situ solidification of low-and medium-level waste. Z.Boguslawski, E.Dumont, W.Guber (F.J. Gattys Verfahrenstech. GmbH, Neu-Isenburg, Germany).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.867-71
The in-situ solidification process requires a preconditioning of MLW/LLW arisings by granulation. The main purpose thereof is the dissipation of the heat of hydration already above ground and to replace in the final concrete like waste form a considerable part (i.e. 60 vol. %) with inert granules. In conventional industry granulation is a well known process but the application in radioactive waste management in compliance with a number of specifications required considerable R&D efforts which are described here. Two dif-

ferent systems which are most appropriate for this process, i.e. the rotating dish as used by R. Koster and coworkers (1980) and the ploughshare mixer, have been investigated till the extent that a comparison between the two processes and their products could be performed. (3 refs.)

65469 Transport of waste into caverns by vertical flow of concrete suspensions. M.Weber, Y.Dedegil (Univ. Karlsruhe, Karlsruhe, Germany), H.H.Homann.
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.873-7
In the process for containerless final storage of radioactive waste, a granule-cement suspension (waste grout) is transported by means of a vertical pipe from above ground into the underground cavern. In order to determine the rheological characteristics of the suspension and the correct pipe diameter required for design of the industrial-scale system, an experimental program was carried out. (no refs.)

65470 Stability and construction of caverns for the disposal of cement low- and medium-level wastes. W.Raab, C.Frohn, M.W.Schmidt (Gesellschaft fur Strahlen- und Umweltforschung mbH Munchen, Inst. fur Tieflagerung, Braunschweig, Germany).
Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste, Berlin, Germany, 7-10 June 1982 (New York, USA: North-Holland 1982), p.879-88
The geomechanical and mining-technological aspects of the construction of salt caverns as disposal chambers have been investigated. With a view towards the stability analysis of such a cavern, FEM-estimates have been carried out and evaluated. From these it can be derived that a rotational ellipsoid would be the most suitable shape; its dimensions should be 82 m (vertical axis) and 42 m (horizontal axis); and the distance (safety pillar) between the neighbouring caverns should be 170 m (vertical) and 180 m (horizontal). For practical engineering purposes the rotational ellipsoid can be modified into a cylinder with conic bottom and top. The characteristics of partially and completely filled caverns were simulated. It was shown clearly that deformation of the salt rock comes to a halt when counteracted by the filling. Based upon the results of the stability analysis, investigations were made to find out a suitable mining technique for the construction of the cavern. (3 refs.)

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems .... See Entry 64588

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics .... See Entry 64589

Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste .... See Entry 64593

Evaluation of neutron cross sections for vanadium .... See Entry 65268

Average number $\bar{\nu}_p$ of prompt neutrons in the fission of ^{236}U nuclei by neutrons in the energy range 0.8-6 MeV .... See Entry 65298

Determination of the cumulative yields of short-lived products of thermal-neutron ^{239}Pu fission by means of the γ-spectrometric method under cyclic conditions .... See Entry 65299

Numerical treatment of the cladding mechanics in the fuel rod computer code IAMBUS .... See Entry 65311

Curve fitting to defect size distributions for the calculation of failure probabilities .... See Entry 65314

Laminar flow induced deflections of stacked plates .... See Entry 65315

Non-linear dynamic-impact simulation of process equipment tubes with tube/support plate interaction .... See Entry 65331

Flow-induced fatigue failure of structures. A sensitivity analysis .... See Entry 65334

Powder metallurgy techniques in nuclear technology .... See Entry 65472

Oxidation of uranium and plutonium mononitride and monocarbide briquettes .... See Entry 65473

Density and viscosity of fused mixtures of uranium chlorides and potassium chloride .... See Entry 65474

Decontamination factors and release rates of UO$_2$ particles from boiling pools of sodium .... See Entry 65484

FRAP-T6 uncertainty study of LOCA tests LOFT L2-3 and PBF LLR-3^a .... See Entry 65615

Design basis leak analyses for designing the sodium-water reaction products subsystem for the large developmental plant .... See Entry 65647

Synthesis of clad motion experiments interpretation: codes and validation .... See Entry 65651

Fuel penetration of intersubassembly gaps in LMFBRs (a calculational method with the SIMMER-II code) .... See Entry 65655

Liberation of helium in the heating of irradiated boron carbide .... See Entry 67053

In situ studies of the effects of ion beams on materials using the electron microscope ion beam interface .... See Entry 67055

Uniaxial stress relaxation and creep behaviour in weldments of the pressure vessel steel A533B between 600 and 640°C .... See Entry 68574

28.42H Fuel preparation and reprocessing

(inc. isotope separation and enrichment)

65471 Fundamental study on separation of uranium from other metals by solvent extraction with tributylphosphate or tributylphosphine oxide in molten naphthalene. Y.Shigetomi, T.Kojima, H.Kamba (Dept. of Chem., Okayama Coll. of Sci., Okayama, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.140-4 (Feb. 1983).
The extraction behaviors of U and other metals has been studied as functions of the concentration of nitric acid or hydrochloric acid in aqueous media and as functions of the amount of naphthalene as diluents, when tributylphosphine oxide (TBPO) or tributylphosphate (TBP) was used as a extractant. The extraction phases could be easily separated as a solid by cooling to room temperature. Uranium could be separated from alkaline earth metals, transition metals and rare earth metals, and U was efficiently concentrated by extraction with molten naphthalene, compared with usual solvent extraction which used toluene, etc. (8 refs.)

65472 Powder metallurgy techniques in nuclear technology. P.G.Mardon (Chem. Div., AERE, Harwell, England).
Powder Metall. (GB), vol.26, no.1, p.1-9 (1983).
The nuclear application of conventional powder metallurgy routes is centred on the fabrication of ceramic fuels. The stringent demands in terms of product performance required by the nuclear industry militate against the use of conventional powder metallurgy to produce metallic components such as the fuel cladding. However, the techniques developed in power metallurgy find widespread application throughout nuclear technology. Illustrations of the use of these techniques are given in the fields of absorber materials, ceramic cladding materials, oxide fuels, cermet fuels, and the disposal of highly active waste. (47 refs.)

65473 Oxidation of uranium and plutonium mononitride and monocarbide briquettes. G.P.Novoselov, V.V.Kushnikov, V.A.Baronov, V.P.Serebryakov, N.M.Stepennova.
Sov. At. Energy (USA), vol.53, no.2, p.528-32 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.77-80 (Aug. 1982). [received: April 1983]
The prospects for using oxygen-free compounds of uranium and plutonium in composite fuels have stimulated research on schemes for reprocessing such rods. The scheme for reprocessing mixed nitride and carbide uranium-plutonium fuel should provide for isolating the main portion of the gaseous and volatile fission products. Here an oxidation process can be used, in which the structure of the initial fuel material is altered, with increase in volume and release of these fission products. The purpose of examining the oxidation of unirradiated mixed nitride–carbide uranium–plutonium fuel was to determine the effects of oxidation conditions on the completeness of the oxidative recrystallization in steady and dynamic states, and also on the phase transitions and the grain-size composition of the products. (8 refs.)

65474 Density and viscosity of fused mixtures of uranium chlorides and potassium chloride. S.F.Katyshev, Yu.F.Chervinskii, V.N.Desyatnik.
Sov. At. Energy (USA), vol.53, no.2, p.565-6 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.108-9 (Aug. 1982). [received: April 1983]
The possibility of using fused uranium chlorides as an electrolyte in obtaining and refining uranium metal as well as in reprocessing spent nuclear fuel necessitates a profound and comprehensive study of the physicochemial properties of multicomponent systems. The authors give the results of investigations of the density and viscosity of fused three-component KCl-UCl$_3$-UCl$_4$ mixtures and the viscosity of KCl-UCl$_4$ mixtures over wide ranges of temperature and concentration. (5 refs.)

65475 Expected performance of spent LWR fuel under dry storage conditions. V.Pasupathi, D.Stahl.
Report EPRI-NP-2735, Electr. Power Res. Inst., Palo Alto, CA, USA (Dec. 1982), 46 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
A review of available data for evaluating LWR spent-fuel performance under dry storage conditions is presented. A number of spent-fuel degradation mechanisms applicable to the dry storage environment are discussed, and conclusions are addressed.

Management of radioactive wastes in Europe (EC) history, philosophy and plans for the next five years .... See Entry 65440

28.43 FISSION REACTOR OPERATION

65476 On the low-frequency spatial dependence of the neutron response and noise field in LWRs. G.T.Analytis (Swiss Federal Inst. for Reactor Res., Wurenlingen, Switzerland).
Ann. Nucl. Energy (GB), vol.10, no.5, p.221-32 (1983).
By employing a 1-D homogeneous reactor model in conjunction with a simple-thermohydraulics BWR feedback model proposed by others, it is shown that contrary to the zero-power case which predicts point-kinetics behaviour at very low frequencies (below 0.1 Hz), when strong feedback effects are present, there will be significant space-dependent effects even at low frequencies and that the importance of these effects will be proportional to the reactor power and the coefficients of reactivity. By using realistic data corresponding to a commercial BWR, the importance of the higher harmonics in the low-frequency region is assessed, and the detector response as well as the coherence function are evaluated for different void reactivity coefficients. The numerical results are in agreement with experimental measurements in commercial BWRs and show that in the frequency region where feedback effects are dominant, the point model is not valid, the 'global' field of view of the detectors is drastically reduced and, for spatially-distributed and radially-uncorrelated noise sources, the coherence function between two detectors located at different radial positions decreases dramatically. (23 refs.)

65477 On the physical meaning of the fluid velocity measured in BWRs by noise analysis. D.Lubbesmeyer (Swiss Federal Inst. for Reactor Res., Wurenlingen, Switzerland).
Ann. Nucl. Energy (GB), vol.10, no.5, p.233-41 (1983).
The author deals with the question of the physical nature of the fluid velocity measured by analysing the noise signals of incore neutron chambers in an operating BWR. It is postulated by phenomenological arguments and proved by measurements that the measured velocity is usually the volumetric flux. The advantage of this finding is the fact that it now becomes very easy to determine the mass flux because in addition, only the steam quality x is needed and this can be commuted with the enthalpy balance using the axial neutron-flux distribution which can be easily measured. Because in a BWR the instrument tube with the neutron chambers is surrounded by four bundles which may not have equal power distributions and/or may have different mass-flows (and hence, different two-phase flow patterns), the influence of the four bundles on the result of the fluid-velocity measurements may differ with respect to the axial position where the measurement is performed. This means that it is plausible that while in one axial position the volumetic flux in one bundle is measured, in another axial position, the fluid velocity in another bundle is dominant. (14 refs.)

65478 The present state of development and the future of the high-temperature reactor in the United States of America. W.A.Simon, H.-W.Chi (General Atomic Co., San Diego, CA, USA).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.62, no.12, p.1011-14 (Dec. 1982). In German.
The American prototype high-temperature reactor at Fort St. Vrain has been operating successfully for years. To date it has produced more than 3,000,000,000 kilowatt hours of electricity and a short while ago was cleared for operation at full load. Operating experience justifies expectations that the combined cycle HTR plant of 2240 MW thermal output favoured by the US Government and industry will offer significant economic advantages. (no refs.)

65479 Identification of BWR feedwater control system using autoregressive integrated model. S.Kanemoto, Y.Andoh (Nippon Atomic Industry Group Co. Ltd., Kawasaki, Japan), F.Yamamoto, M.Idesawa, K.Itoh.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.105-16 (Feb. 1983).
With a view to contributing towards a more reliable interpretation of noise behavior under normal operating conditions, which is essential for correct detection and/or diagnosis of incipient anomalies in nuclear power plants by noise analysis techniques, studies have been undertaken of the noise behavior in a BWR feedwater control system, using a multivariate autoregressive modeling technique. Noise propagation mechanisms as well as open- and closed-loop responses in the system are identified from noise data by a method incorporating an autoregressive integrated model. The closed-loop responses obtained with this method are compared with transient data from an actual test, and confirmed to be reliable in estimating semi-quantitative features. Other analyses performed with this model also yield results that appear reasonable in their physical characteristics. (17 refs.)

65480 Strength analysis of the vertical flow steam generators of nuclear power plants. M.Niezgodzinski, W.Zwolinski (Politech. Lodzka, Lodz, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.217-24 (1981). In Polish.
An analytical method is considered for calculation of the internal stresses and forces in the main elements of vertical flow steam generators. The heating tubes make an elastic foundation supporting the perforated bottoms. The bottoms are assumed to be ortotropic plates joined with a cylindrical shell and hemispherical or elliptical heads. Solutions are given for any conditions of exploitation. (8 refs.)

65481 Electromagnetic pumps for nuclear power. I.R.Kirillov.
Magnetohydrodynamics (USA), vol.18, no.3, p.284-92 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.87-97 (July-Sept. 1982). [received: April 1983]
In fast reactors the coolant usually consists of alkali metals, mainly sodium, which is circulated in the main loops primarily by mechanical and in auxiliary loops (filling, drainage, cleaning the metal, washing fuel assemblies, etc.) by electromagnetic pumps (EMP). EMP with power up to 100 kW have almost completely replaced mechanical pumps even in research and technological installations. The increasing demands for EMP, the commencement of design and construction of series stations with fast reactors, and the accumulated experience in making and using pumps permit proceeding with the creation of series EMP with power up to 100 kW and large EMP for the main loops in nuclear power plants. The author examines the technique used in the computational and design work in creating series induction EMP used in NIIEFA. A series of pumps intended for pumping sodium into auxiliary fast reactor systems and research stands are based on scales of pressures, flow rates (powers), and the working body temperatures. For asynchronous electrical machines such scales have come about as a result of extensive experience in developing and using series machines. (24 refs.)

65482 Flow recovery from a single subchannel blockage in a square-pitched rod array. J.D.Hooper (Lucas Heights Res. Lab., Australian Atomic Energy Comm. Res. Establ., Sutherland, NSW, Australia), D.H.Wood.
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.91-103 (Jan. 1983).
The flow recovery downstream of a sharp edged plate blockage of one subchannel for axial flow through a square-pitched, six-rod array has been investigated for a rod pitch to rod diameter ratio of 1.107. Wall shear stress, local axial velocities, secondary flow velocities, and all terms of the Reynolds stress tensor were measured. Mean and turbulent components of the air flow were measured by Pitot-static and hot-wire anemometer probes at several axial locations downstream of the blockage for a Reynolds number of 48×10^3. (14 refs.)

65483 Laser doppler measurements of flow in a rod bundle. S.Neti (Mech. Engng. & Mech., Lehigh Univ., Bethlehem, PA, USA), R.Eichhorn, O.J.Hahn.
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.105-16 (Jan. 1983).
A two component laser doppler velocimeter with polarized beams and frequency shift was used to measure the turbulent flow field for axial flow between the rods of a nine rod, square pitch rod bundle. Parameters measured include mean axial and lateral velocities, turbulence intensities and the friction factor. (16 refs.)

65484 Decontamination factors and release rates of UO_2 particles from boiling pools of sodium. A.Dayan, S.Zalmanovich (Dept. of Fluid Mech. & Heat Transfer, Tel-Aviv Univ., Tel-Aviv, Israel).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.127-32 (Jan. 1983).
A semi-mechanistic model for calculating solid radionuclide release rates from boiling or bubbling pools of sodium is developed. The influence of particle spacial and size distributions on the decontamination of the releases is analysed. Decontamination factors are shown as a function of pool depth, bubbling characteristics and particle size distribution. The calculation of a decontamination factor for estimating the source term of large scale hypothetical core disruptive accidents is presented. (11 refs.)

65485 Two-phase flow instability in channels with sinusoidal heat supply. E.Lorenzini, C.Crescentini, M.Spiga (Istituto di Fisica Tecnica, Univ. di Bologna, Bologna, Italy).
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.133-7 (Jan. 1983).
The authors deal with the problem of Ledinegg instability for two-phase flow in systems reproducing the operative conditions of the channels between the fuel rods of a boiling nuclear reactor. Particular attention is devoted to the influence of the heat flux distribution. In addition, a numerical method is applied to predict the occurrence of two-phase flow instability. (3 refs.)

65486 Method for automatic monitoring of iodine radioactivity in the water coolant of an atomic power plant. L.N.Moskvin, V.W.Miroshnikov, V.A.Mel'nikov, I.S.Orlenkov, V.V.Chetverikov.
Sov. At. Energy (USA), vol.53, no.2, p.551-3 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.101-2 (Aug. 1982). [received: April 1983]
The use of a rapid chromatographic method for separating the reference radionuclides from water media on block selective sorbents greatly simplifies radiochemical monitoring of the coolant in an atomic power plant. The maximum use of the capabilities of instrumental analysis on which the method is based, as well as the simplification and great decrease in the number of chemical operations, permits creating comparatively easily automated radiochemical monitoring systems. The authors specifically studied the possibility of automating the monitoring of iodine radionuclides in the water coolant, which are reference nuclides for evaluating the hermetic seal of fuel-element jackets from radiochemical data. (2 refs.)

65487 Magnetic flux leakage for measurement of crevice gap clearance and tube support plate inspection. W.Lord.
Report EPRI-NP-2857, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 60 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
The design, construction, and operation of an 8-Hall element variable reluctance probe suitable for field use and capable of predicting the crevice gap clearance at eight discrete points around the circumference of the tube are detailed. Prechemical and postchemical flushing tests on a model boiler are described to illustrate the use of the probe, and suggestions are made for further probe refinement.

65488 Experiments on heat transfer crisis and hydraulic resistance in a 19-rod bundle. N.V.Tarasova, V.I.Kisina, T.A.Vanttola, O.M.Tiihonen.
Report 154, Tech. Res. Centre Finland, Electr. Eng. Lab., Espoo (Feb. 1983), 69 pp.
An experimental program was carried out, where heat transfer and hydraulic resistance were measured in a facility that simulated a fuel assembly of a Soviet VVER-440 nuclear power reactor. The experiments were performed in a test loop with four different rod bundles that consisted of 19 full height, directly electrically heated rods. Most of the tests were conducted close to nominal conditions of the simulated reactor. Heat transfer crisis of dryout type was measured at mass fluxes from 15 to 40% of the nominal flow of the reactor, when inlet temperature of flow and heat flux were varied in the neighbourhood of the nominal reactor values. The single- and two-phase heat transfer coefficients, single-phase friction, two-phase friction and the local minimum of friction were obtained. (21 refs.)

65489 Simulation of a digitally controlled system, using the SIMUL language: design of an anti-reset windup integral and state feedback controller. F.Gorez (Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.106-9 vol.3
The SIMUL simulation language is introduced and its application to thesimulationof continuous-time systems controlled by digital computers is described. Then, the control of the primary coolant temperature in a PWR nuclear power plant is considered. Large disturbances induce unacceptable transient oscillations due to the actuator speed limits; it is shown that these oscillations can be damped or eliminated, using a correction algorithm with a single parameter, the value of which can be determined via simulation. (10 refs.)

65490 Stability studies of a CANDU heat transport circuit. H.W.Hinds, P.D.McMorran, C.M.Tseng (AECL, Chalk River Nuclear Labs., Chalk River, Ontario, Canada).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.53-6 vol.4
Thermal-hydraulic instabilities are possible in a figure-of-eight CANDU primary heat transport circuit when the coolant boils. A linearized model using transmission matrices in the frequency domain has been developed. Its predictions agree favourably with results from an experimental loop. The use of secondary feedwater control to stabilize the circuit was examined and found not to be practical. (7 refs.)

65491 MAXI-LILLIPUT: a simplified model of a French pressurized water reactor power plant. J.-L.Tyran (Electricite De France, Chatou, France).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.60-2 vol.4
Describes a simplified model of a French pressurized water reactor (PWR) power plant. The goal of this model is the simulation of the xenon effect and his consequence on the core axial power distribution with a reactor control by means of grey rods during load-following operations and remote control (e.g. from an automatic dispatch center). The author studies the effects of principal design parameters on the dynamics and controlled performances of a power plant: a study of load-following capability. LILLIPUT is a good simplified model with primary and secondary parts, but the core is punctual. MAXI-LILLIPUT is an extension of LILLIPUT with an axial core representation. (4 refs.)

65492 TRAC-BWR—a best estimate code for transient thermal hydraulic analysis of a BWR. J.G.Munthe Andersen, B.S.Shiralkar (General Electric Co., San Jose, CA, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.98-100 vol.4
TRAC-BWR (transient reactor analysis code for a Boiling water reactor) is a best estimate computer code for the analysis of transient thermal hydraulic phenomena in a boiling water reactor (BWR). The tasks involved in the development of the present version of TRAC-BWR, have involved significant changes to the structure of the code, development of new modules for the BWR components, such as jet pumps, steam separators, and fuel bundles, and the development of models for phenomena of particular importance in the BWR, such as accurate void fraction prediction and radiative heat transfer. The present version of TRAC-BWR is able to simulate all significant transient thermal hydraulic phenomena in a BWR. Moreover, due to the modular structure of the code, TRAC-BWR can be used to analyze heat transfer and two-phase flow for a range of applications, such as test loops, process heat transfer, etc. (3 refs.)

65493 Modeling of containment response to the dispersive mode of PWR vessel failure. J.C.Reck (Westinghouse Electric Corp., Pittsburgh, PA, USA), R.E.Henry, L.A.Wooten.
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.101-4 vol.4
When a Class 9 accident is postulated for some PWR designs, the failure of the reactor vessel while significant internal pressure exists could lead to dispersion of molten debris over the containment floor. This debris would be quenched by the water it contacts and result in a steam spike which, when coupled with a hydrogen burn could challenge the containment pressure limit. The MARCH code alone is inadequate for modeling this type of vessel failure phenomena. Through the use of a newly developed Dispersive Event Model, called DEMO, this scenario can be modeled when used with MARCH and a modified COCO code. Each of these computer codes is briefly discussed followed by a more detailed discussion of DEMO. (5 refs.)

65494 Verified simulation of a nuclear reactor transient in real time: stuck pressurizer relief valve. P.W.Wyatt, F.C.Luffey (Westinghouse Electric Corp., Pittsburgh, PA, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.105-7 vol.4
One of the classical plant transients which a simulator should be capable of handling is a stuck-open power-operator relief valve event. The paper gives a description of such a transient which is a comparison of the calculated and measured behavior for the situation using a SEL 32/77 minicomputer. (6 refs.)

65495 A three-dimensions kinetic code for PWR reactor. J.C.Barral (Electricite de France, Courbevoie, France), F.Blanchon, J.C.Lefebvre, J.Planchard, R.Seban.
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.108-10 vol.4
A 3-dimensional kinetic code coupled with a thermal hudraulic model is presented. The numerical methods used by this program are described and are illustrated by an example concerning a very fast transient (control rod ejection). (7 refs.)

65496 BWR loss of coolant technology review. G.E.Dix (Nuclear Fuel & Special Projects Div., General Electric Co., San Jose, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.3-19 vol.1
Over the past few years an integrated technology program has been pursued with the objective of defining the detailed response of the Boiling Water Reactor (BWR) for the entire spectrum of postulated loss of coolant inventory conditions The author summarizes the controlling phenomena for BWR transient events and identifies the similarities among results from the experimental facilities of various scales. (14 refs.)

65497 A review of current heat transfer correlations used in reactor safety assessment. D.C.Groeneveld, C.W.Snoek (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.20-8 vol.1
The authors summarize the result of a two-year review of published heat transfer predictive methods for reactor thermohydraulic analysis. All heat transfer modes, with the exception of condensation, were considered in this study. Where possible, the correlations considered were examined for their asymptotic and parametric trends. It is concluded that the most important heat transfer regimes (CHF, Transition Boiling, Film Boiling) have a limited data base. As a consequence, the correlations are not valid for the complete range of loss of coolant accident conditions and unjustified extrapolations of the correlations are common. To improve the prediction accuracy, it is suggested that a combination of empirical correlations with appropriate transition regimes and extrapolation factors to used. These extrapolation factors are designed to permit the correlations to be used over a wider range of conditions and geometries. (39 refs.)

65498 Detailed modelling of two phase flow and its application to system prediction. G.F.Hewitt (Engng. Sci. Div., Harwell Lab., Harwell, England).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.38-48 vol.1
Following a brief discussion of the deficiencies of the widely used empirical modelling methods, the development of more phenomenologically based models is discussed in the particular context of the prediction of gas-liquid flows. It is shown how the development of modern techniques for drop size and drop motion measurement may be used to throw more detailed light on the physical mechanisms. The next area explored is that of interfacial phenomena in two phase flow, with particular reference to wave behaviour and its link to shear stress in annular flow. Finally, a range of examples are given of the applications of phenomenological modelling, these applications being selected where possible to link closely with the general papers being presented in this sessions. The examples include flows in 'singularities' (venturis, nozzles) and flows in diabatic systems with departure from thermodynamic equilibrium. (19 refs.)

65499 Degraded core heat transfer. P.Ihle (Inst. fur Reaktorbauelemente, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.49-59 vol.1
The author discusses LOCA heat transfer conditions in slightly to severely disturbed PWR rod bundle geometries. Experimental results obtained out-of-pile are discussed showing that even coolant channel constrictions of up to 90% do not lead to core coolability problems for reduced reflood water injection rates corresponding to flooding velocities as low as 2 cm/s. However, thermal-hydraulic experiments cover the core temperature range below 1000 C only. Therefore, investigations are mentioned which can be used for obtaining information about the conditions at initiation as well as at termination of possible core degradation. (27 refs.)

65500 Condensation effects in reactor transients. W.Kirchner (Los Alamos Nat. Lab., Los Alamos, NM, USA), S.G.Bankoff.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.60-8 vol.1
Some recent results pertinent to condensation as it affects the course of LWR transients are reviewed. These include interfacial shear stress, local condensation heat transfer coefficients, and stability of stratified countercurrent steam-water flow. Cold-leg, and combined cold and hot leg, oscillations are also discussed. Some avenues for further research are pointed out. (35 refs.)

65501 Lessons in reactor thermal-hydraulics from operating plant transients. S.Levy (S. Levy Inc., Campbell, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.69-75 vol.1
The author presents lessons learned in reactor thermal hydraulics from operating plant transients, and the prediction of such effects. (14 refs.)

65502 A review of flow-induced vibrations in reactors and reactor components. M.P.Paidoussis (Dept. of Mech. Engng., McGill Univ., Montreal, Quebec, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.76-98 vol.1
The author presents a review of the state of the art of two classes of vibration problems encountered in reactors and reactor peripherals, namely vibration of cylindrical structures induced by cross flow and by axial flow. A historical perspective is given first, in which the milestone contributions that have advanced the state of the art are highlighted. Then recent developments in the last decade, with emphasis on those in the last three years, are discussed, concluding with an assessment of the state of understanding of the fluidelastic mechanisms involved, on the one hand, and of predictive tools available to the designer, on the other. (240 refs.)

65503 Applied mathematical methods in nuclear thermal-hydraulics. V.H.Ransom (EG&G Idaho Inc., Idaho Falls, ID, USA), J.A.Trapp.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.99-110 vol.1
Applied mathematical methods are used extensively in modeling of nuclear reactor thermal-hydraulic behavior. This application has required significant extension to the state-of-the-art. The problems encountered in modeling of two-phase fluid transients and the development of associated numerical solution methods are reviewed and quantified using results from a numerical study of an analogous linear system of differential equations. In particular, some possible approaches for formulating a well-posed numerical problem for an ill-posed differential model are investigated and discussed. The need for closer attention to numerical fidelity is indicated. (19 refs.)

65504 Radionuclide scrubbing in water pools: bubble hydrodynamics. L.J.Flanigan, D.D.Paul, R.P.Collier, R.A.Cudnik (Battelle's Columbus Labs., Columbus, OH, USA), R.N.Oehlberg.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.137-44 vol.1
In assessing the severity of degraded core accidents in light water reactors, limited credit is taken currently for scrubbing of fission products, either vapors or aerosols, in water pools. The development and use of more realistic scrubbing decontamination factors (DFs) could have a significant effect on the perceived safety of nuclear power plants. The authors present the results of the first phase of the experimental program, a study of hydrodynamics of steam/noncondensible gas mixtures injected into a water pool through a single orifice. (25 refs.)

65505 Two-phase redistribution in horizontal subchannel flow—turbulent mixing and gravity separation. M.Shoukri, H.Tawfik, A.M.C.Chan (Res. Div., Ontario Hydro, Toronto, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.145-52 vol.1
The redistribution of two-phase flow in two horizontal interconnected subchannels caused by gravity separation and turbulent mixing has been investigated experimentally using an air-water loop. The measured redistribution data included the axial distribution of void fraction and liquid and gas flow rates in the two subchannels. The redistribution data exhibited an asymptotic behaviour, approaching certain flow distributions independent of the inlet distribution. The observed equilibrium distributions were explained as a balance between gravity forces and turbulent diffusion. A constitutive equation for transverse vapour drift, to account for both gravity separation and turbulent diffusion, is presented and a turbulent mixing coefficient identified. (13 refs.)

65506 A comparison of flow regime behaviour in adibatic and diabatic two-phase flow trefoil simulations. M.K.Nicholson (Dept. of Chem. & Petroleum Engng., Univ. of Calgary, Calgary, Alberta, Canada), J.R.Nickerson.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.153-60 vol.1
Flow regime studies were made with a 20.0 mm hydraulic diameter horizontal trefoil under simulated adiabatic and diabatic boiling flow conditions. A low pressure transparent test section using a two component air-oil fluid system was equipped with porous tubes to generate three simulated axial heat flux profiles. The same test section was then used to simulate adiabatic flows over a matching set of mass velocities using an upstream mixer. Flow regimes were studied visually and revealed that the adiabatic regimes compared well with those encountered earlier with a 25.8 mm hydraulic diameter annulus and tube with the same fluid system. (9 refs.)

65507 Two-phase instability in nozzle flows of bubbly liquid. G.Matsui, S.Morioka (Inst. of Engng. Mech., Univ. of Tsukuba, Ibaraki, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.161-9 vol.1
The interrelation between local behaviour of bubbles and main flow in a bubbly liquid two-phase flow is investigated theoretically and experimentally. A model taken account of slip and volume-oscillation of bubbles predicts that two kinds of instability mechanism may exist in a bubbly liquid flow. These instabilities exhibit individual features in main flow condition for occurrence, spectrum of growing wave and connection with local behaviour of bubbles. In order to examine such instability mechanisms and their effects on behaviour of bubbles and main flow, an experiment on nozzle flow of bubbly liquid is performed by using a nitrogen-water two-phase loop. (8 refs.)

65508 Flow through a small break at the bottom of a large pipe with stratified flow. J.Reimann, M.Khan (Inst. fur Reaktorbauelemente, Kernforschungszentrum Karlsruhe GmbH, Karlsruhe, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.170-7 vol.1
A small break of a horizontal coolant pipe is investigated. This flow geometry and accident scenario are of interest in nuclear reactor safety research. Results are presented on the mass flow rate and quality distribution as a function of a dimensionless interface level. (21 refs.)

65509 Flooding experiments in tubular geometry with steam-water up to 70 bar. L.Augello, R.Martini (CIS, Milano, Italy).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.178-83 vol.1
An experimental study has been performed to obtain counter-current flow limitation data over a range of conditions as near as possible to that of a PWR pressurizer surge-line. Measurements of the water flowrate and of the pressure drop versus the steam flowrate are presented, and analyzed in terms of the Wallis parameters. (4 refs.)

65510 Parameters for the scaling of oscillatory two-phase flows. A.E.Levin, B.H.Montgomery (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.184-92 vol.1
Sodium boiling is an important phenomenon in the analysis of hypothetical accidents in liquid metal fast breeder reactors. Tests have been performed in

two sodium loops to study sodium boiling behavior. Testing is currently under way in the simulant boiling flow visualization loop (an atmospheric pressure, single-tube water experiment, to study oscillatory flows by direct visual means). Several dimensionless parameters have been derived to aid in properly scaling the experiments and analyzing the data. (6 refs.)

65511 De-entrainment of liquid on vertical rods in air-water cross flow. R.K.Sundaram (Nuclear Engng. Dept., Yankee Atomic Elec. Co., Framingham, MA, USA), J.C.Chen, J.C.Dallman.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.193-201 vol.1
Liquid holdup on a vertical rod has been measured in air-water cross flow at various air and water flow rates. The measurement technique involved the use of band-type capacitance probes which are capable of measuring the liquid film thickness around the rod circumference. A simple model, based on laminar flow theory, is shown to reasonably explain the trends in film thickness variation. (10 refs.)

65512 Drop motion and deposition in annular two-phase flow. N.S.Wilkes, B.J.Azzopardi, I.Willetts (Engng. Sci. Div., AERE Harwell, Didcot, England).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.202-9 vol.1
The simulation model for drop motion in annular two phase flow developed by James et al. (1980) has been extended, tested against experimental data and used to gain insights into aspects of annular two phase flow. The effect of drop size and gas velocity on drop velocity has been examined. The model has also been used to study the evolution of drop size spectra. Simulations have been made of deposition experiments where drops were injected singly at the tube centre line. (16 refs.)

65513 Analysis and experiments of droplet trajectories in sprays. R.K.E.Cossmann, G.B.Wallis, H.J.Richter, C.P.Thron (Thayer School of Engng., Darmouth Coll., Hanover, NH, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.210-17 vol.1
The influence of steam condensation on the shape of subcooled water sprays was investigated. In the theoretical model the water is assumed to act as vapor sinks and thus create a velocity field in the steam. The resulting force on the spray water is used to compute the final spray shape. Measurements with single full scale BWR spray nozzles were performed. The droplet size and the water distribution were measured as a function of steam pressure and vertical distance from the nozzle exit. (7 refs.)

65514 Some details of developing slugs in horizontal two-phase flow. E.Kordyban (Univ. of Detroit, Detroit, MI, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.218-25 vol.1
A photographic study has been carried out to uncover the details of development of slugs in horizontal two-phase flow. Based on the observations it is proposed that the slugs originate as a consequence of local Kelvin-Helmholtz instability at the wave crest, rather than the instability of the whole wave. (15 refs.)

65515 The application of a charnock-based estimate of interfacial stress to some near-horizontal, stratified two-phase flows. Y.L.Sinai (R&D Technol., Nat. Nuclear Corp. Ltd., Warrington, England).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.226-34 vol.1
Heurstically-derived mixing length distributions are invoked in a calculation which leads to closed-form solutions for the fully-developed turbulent velocity field of a single-phase fluid moving in a plane channel, with arbitrary conditions imposed at the walls. The results are then applied to the liquid flow in planar, stratified two-phase flow, and when the interfacial stress is significant the mean liquid flow is determined analytically. This analysis bears upon the stratified phenomena which arise in PWR accidents, in particular the small LOCA. (25 refs.)

65516 Wave dispersion effects in two-phase flow. L.Y.Cheng, D.A.Drew, R.T.Lahey,Jr. (Rensselaer Polytech. Inst., Troy, NY, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.235-45 vol.1
A wave dispersion relation for a two-component, two-phase flow was derived from a two-fluid, two-pressure model. The one-dimensional space/time averaged conservation equations of mass, momentum and energy for each phase were used to describe the dynamics of the two-phase mixture. The Rayleigh equation was used to describe the dynamics of a pulsating bubble and relate the phasic pressures. Heat conduction between the pulsating bubbles and the surrounding liquid was also modeled. The dispersion relation was derived from the linearized conservation equations and the Rayleigh equation. (27 refs.)

65517 Shock phenomena in a one-component two-phase bubbly flow. K.Akagawa, T.Fujii, Y.Ito, S.Hiraki, T.Kitano, S.Tsubokura (Dept. of Mech. Engng., Kobe Univ., Kobe, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.246-51 vol.1
Characteristics of shock phenomena induced by a quick valve closure at the downstream end of a channel are investigated. An experiment was conducted for a two-phase bubbly flow in a horizontal stainless tube with a surge tank having a gas chamber at the upstream end. Freon 113 was used as the working fluid. The pressure transients were measured at four locations along the tube. The profiles of the transient pressure, the potential surge, the equilibrium pressure rise, and the propagation velocity of the compression wave are presented and are discussed, comparing them with those in an air-water two-component two-phase flow. (10 refs.)

65518 Flow regime and heat transfer measurements during reflooding with steady and oscillatory coolant injection. M.Kawaji, Y.S.Ng (Dept. of Nuclear Engng., Univ. of California, Berkeley, CA, USA), S.Banerjee.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.262-70 vol.1
Simultaneous void fraction and wall temperature measurements were made during bottom-reflooding of a vertical Inconel tube with inlet flows consisting of various constant and oscillatory injection rates. To support interpretation of these data, flow regime visualization experiments were also done on reflooding of a heated quartz tube under similar inlet flow conditions. (16 refs.)

65519 Dryout and post-dryout heat transfer in helically coiled tubes. M.Kaji, S.Nakanishi, S.Ishigai, M.Kume, K.Mori (Dept. of Mech. Engng., Osaka Univ., Osaka, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.271-8 vol.1
Dryout at high steam qualities and post-dryout heat transfer to steam-water two-phase flows in helically coiled tubes are experimentally investigated. Dryout mechanism in the coiled tube is investigated by air-water flow experiments. Flow developments in the coiled tube are visualized and flow rates of liquid droplets entrained are measured. (20 refs.)

65520 Effect of system pressure on film boiling heat transfer, minimum heat flux and minimum temperature. A.Sakurai, M.Shiotsu, K.Hata (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.279-85 vol.1
Film boiling heat transfer on a horizontal test heater in a pool of saturated and subcooled water was investigated at pressures ranging from 20 kPa to 2 MPa. A semi-empirical equation and a modified Bromley's equation are given, both of which could express the saturated film boiling heat transfer coefficients. The heat transfer coefficients under saturated and subcooled conditions are expressed by the two-phase boundary layer film boiling model with the boundary condition of equal liquid and vapor interfacial velocities. Empirical equations of interfacial wave length, departing bubble diameter and departing bubble frequency at near the minimum film boiling temperature are given. (13 refs.)

65521 A study of subcooled film boiling heat transfer under reactivity initiated accident conditions in light water reactors. N.Ohnishi, K.Ishijima, S.Tanzawa (Div. of Nuclear Safety Res., JAERI, Ibaraki, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.286-94 vol.1
The empirical correlations for subcooled film boiling heat transfer during a reactivity-initiated accident in light water reactors are derived from inverse heat conduction calculations using the cladding surface temperatures measured in in-reactor experiments. The experimental data for cold-startup conditions and hot-standby conditions are used for this investigation. The present correlations are compared with existing correlations from ex-reactor experiments. The results of transient fuel behavior calculations with a computer code which included the present correlations are in good agreement with the corresponding measured data from the experiments. (8 refs.)

65522 The quenching of thick-walled nickel test sections. G.Costigan (Engng. Sci. Div., AERE Harwell, Harwell, England).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.295-302 vol.1
A series of quenching tests have been performed on a composite test section assembled from four thick walled nickel cylinders. The tests were carried out at a pressure of 2 bar at mass fluxes of 50, 100, 150 kg/m^2S and inlet subcoolings of 15°C and 30°C, in both upflow and downflow. The experimental data demonstrate complex post dryout heat transfer behaviour due to the interaction of the various components of the composite test section. Parametric trends show that post-dryout heat fluxes increase with both mass flux and inlet subcooling, in upflow and downflow. In downflow heat fluxes are much lower than those obtained for corresponding inlet conditions in upflow. A simple extension of the Bromley analysis for laminar film boiling can be shown to account for the effects of flow velocity and direction if buoyancy effects are allowed for in downflow. The transition boiling region data indicate that Hsu's correlation will overpredict the measured heat fluxes by a large amount. (18 refs.)

65523 Comparison of flashing heat transfer correlations. T.Siikonen (Nuclear Engng. Lab., Helsinki, Finland).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.303-9 vol.1
Several flashing correlations used in non-equilibrium computer codes have been compared. The comparison has been performed by calculating test cases, where non-equilibrium effects dominate. The test cases include a fast and a slow pressure transient and a critical flow test. (12 refs.)

65524 An appraisal of interfacial vapour generation laws used in thermal-hydraulic analysis. Ph.Vernier, Ph.Berne (Service des Transferts Thermiques, CENG, Grenoble, France).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.310-15 vol.1
The determination of interfacial transfer laws is of primary importance for the development of advanced thermalhydraulic codes. Among these laws, the vapour generation law plays an important role. The authors discuss some vapour generation laws. They are divided into empirical laws and analytical laws. (24 refs.)

65525 Evaluation of nonequilibrium effects in bundle dispersed flow film boiling. D.G.Morris, C.B.Mullins, G.L.Yoder (Engng. Technol. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.316-25 vol.1
The effects of thermodynamic nonequilibrium in dispersed flow film boiling heat transfer are examined. Steady-state and transient rod bundle data are used to evaluate several empirical heat transfer models commonly employed to predict post-CHF behavior. Nonequilibrium effects can also be treated by explicitly modeling the phenomena. The thermal-hydraulic code COBRA-TF employs this approach. Using bundle data the models in the code are evaluated. (31 refs.)

65526 Inferring nonequilibrium vapor conditions in convective film boiling. S.W.Webb (Gilbert Associates Inc., Reading, PA, USA), J.C.Chen.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.326-34 vol.1
Single-phase convective heat transfer correlations are often used to infer nonequilibrium vapor conditions in dispersed flow convective film boiling. The inferred vapor conditions for each correlation were compared to thermodynamic limits for the data. The predicted vapor temperatures were also compared with the new available experimental measurements. (27 refs.)

65527 Post dry-out heat transfer in uncovered core accidents. A.Annunziato, M.Cumo, G.Palazzi (ENEA/TERM-C.R.E. Casaccia, Rome, Italy).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.335-42 vol.1

TMI accident has risen the interest of safety nuclear engineers in a relatively new heat transfer condition in reactor core, i.e. a situation in which the coolant flowrate is so low that the liquid level may be below the active length of the core and a particular type of post dry-out heat transfer dominates the temperature regime in the uncovered region. Therefore, an experimental research has been performed employing a very simple loop with a particularly accurate test section instrumentation for the measure of coolant and wall temperatures. Critical qualities at the dry-out point and post dry-out heat transfer coefficients have been systematically measured and compared with the available correlations. Moreover post dry-out heat transfer has been investigated with particular focus on the entrained droplets population and a droplet size distribution law has been derived by means of the coolant temperature measurements. (21 refs.)

65528 A thermodynamic similarity correlation for modeling of flow boiling dryout. E.G.Hauptmann, V.Lee (Dept. of Mech. Engng., Univ. of British Columbia, Vancouver, BC, Canada).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.352-5 vol.1

A general correlation for CHF during flow boiling dryout was developed using the assumption that true fluid-to-fluid modeling requires simultaneous thermodynamic, hydrodynamic and geometrical similarities. A series of CHF experiments were conducted using CO_2 in a vertical upflow arrangement. More than 1100 data points were taken over a range of reduced pressures coinciding with that of benchmark tests in water and Freon 12. (10 refs.)

65529 Evaluation of performance of eight CHF correlations with the VIPRE-1 computer code. J.M.Cuta (Battelle, Pacific Northwest Labs., Richland, WA, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.356-69 vol.1

The author evaluates the performance of eight CHF correlations within the VIPRE-1 thermal-hydraulic subchannel analysis code. VIPRE-1, is a core thermal-hydraulic code tailored for utility applications. The eight CHF correlations available in the VIPRE-1 code include the three major PWR vendors' correlations: CE-1, B&W 2, W-3S and W-3C. The Columbia-EPRI and Bowring WSC-2 correlations were also compared with a small sample of transient CHF data from BWR-LOCA experiments. (19 refs.)

65530 Application of multi-fluid model in dryout prediction. T.Saito, T.Ishizuka, J.Kimura, T.Kagawa (Toshiba Corp., Tokyo, Japan).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.370-8 vol.1

Dryout predictions using a multi-fluid model for the annular two-phase regime are compared against dryout data obtained for BWR conditions. (20 refs.)

65531 A critical heat flux correlation for triangular array rod bundles with tight lattices. M.D.Donne, W.Hame (Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.379-89 vol.1

Many CHF-correlations have been developed for water cooled rod clusters representing typical PWR or BWR fuel element geometries with relative wide rod lattices. However the fuel elements of an Advanced Pressurized Water Reactor (APWR) have a tight fuel rod lattice, in view of increasing the fuel utilization. Application of the new CHF-correlation to conditions typical for an APWR shows that the predicted critical heat fluxes are much smaller than those calculated with the usual PWR-CHF-correlations, but they are higher than those predicted by the B&W-VPI&SU correlation. (20 refs.)

65532 Evaluation of predictability of multiple CHF events. D.G.Reddy, C.F.Fighetti (Heat Transfer Res. Facility, Columbia Univ., New York, NY, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.390-7 vol.1

The phenomenon of multiple CHF events in rod bundle heat transfer tests is examined. The adequacy CE-1, B&W 2, and Columbia subchannel CHF correlations in predicting higher order CHF events is ascertained based on local coolant conditions obtained with the COBRA IIIC subchannel code. The data from three sets of tests simulating both PWR and BWR reactor cores are studied using a combination of statistical analyses and parametric studies. (10 refs.)

65533 Investigation of transient critical heat flux phenomena and forced convection film boiling heat transfer. I.Vojtek (Gesellschaft fur Reaktorsicherheit, Garching, Germany).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.398-407 vol.1

The authors investigated the transient critical heat flux phenomena and the forced convective film boiling heat transfer coefficients. Post experimental analysis has been performed using the computer code BRUDI-VA, a modified version of blowdown code BRUCH-D. The authors calculated local thermal hydraulic parameters and evaluated different correlations used in the analysis of reactor safety problems for the calculation of maximum and minimum critical heat flux and forced convection film boiling heat transfer coefficients. (23 refs.)

65534 Annular burnout data from rod bundle experiments. G.L.Yoder, D.G.Morris, C.B.Mullins (Engng. Technol. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.408-18 vol.1

Burnout data for annular flow in a rod bundle is presented for both transient and steady-state conditions. Tests were performed with a pressurized-water loop containing an electrically heated 64-rod bundle. The bundle configuration is typical of later generation pressurized-water reactors with 17×17 fuel arrays. Both axial and radial power profiles are flat. All experiments were carried out in upflow with subcooled inlet conditions, insuring accurate flow measurement. (14 refs.)

65535 A simplified finite element model for fully developed axial turbulent flow in rod bundles. M.Abdelghany, M.C.Roco, R.Eichhorn (Dept. of Mech. Engng., Univ. of Kentucky, Lexington, KY, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.421-32 vol.1

A simplified computational scheme that can be efficiently applied to predict fully developed axial flow in rod bundles subchannels is presented, and compared with experimental results for different flow conditions. Galerkin's finite element method and the physical model of turbulence proposed by Roco and Zarea (1976) are used in this approach. The flow in the corner, wall and central subchannels for both triangular and square rod bundles is investigated. Different values of the subchannel pitch to diameter ratio and various Reynolds numbers are considered. In all these cases, the present computational scheme gives the correct qualitative trends for the distributions of the axial velocity and wall shear stress. (23 refs.)

65536 Formulation of a two-fluid model for mixing in LWR bundles. M.S.Kazimi (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA), J.E.Kelly.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.433-9 vol.1

The space and time averaged two-fluid flow equations are shown to lead to distributive and turbulence terms, which can be lumped into one term to explain two-phase lateral mixing in rod bundles. A model is developed for this mixing and applied into the THERMIT two-fluid code. The model predictions were tested against small rod bundle tests for pressure and quality conditions representative of BWR and PWR conditions. (13 refs.)

65537 Application of a discontinuity-tracking-technique to thermal-hydraulics analysis. U.Graf, J.Miro, A.Schaefer, W.Werner (Gesellschaft fur Reaktorsicherheit mbH, Garching, Germany).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.440-8 vol.1

Transient analysis of nuclear power plants requires a detailed description of the coolant thermal-hydraulics during rather long periods of time. In order to calculate those transients, very efficient methods have to be used for space- and time-integration of the differential equations describing the two-phase-flow of the coolant fluid and the heat transfer in the primary and secondary loops of the plant. To show the applicability of physical models for describing the thermal-hydraulics of transient two-phase flow, a new developed two-phase flow model has been taken. This is a four-equations model and is believed to be the simplest model that can describe accurately kinematic non-equilibrium between phases. The authors give an analysis of both, the fixed grid and the local 'Langrange' ASWR method, when applied to this four-equations model. (12 refs.)

65538 A numerical algorithm for calculating steady-state flow splits. L.V.Ellis (Energy Inc., Idaho Falls, ID, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.449-60 vol.1

The author presents an extension of a proven algorithm for determining the steady state when flow splits are known a priori to the case in which corresponding junction form loss coefficients supplant knowledge of flow rate splits in the set of initially known steady-state data. (3 refs.)

65539 A multigrid scheme for the thermal-hydraulics of a blocked channel. M.Lacroix, R.Camarero, A.Tapucu (Ecole Polytech. de Montreal, Montreal, Quebec, Canada).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.461-9 vol.1

An efficient scheme has been developed for the numerical solution of the Navier-Stokes and energy equations applied to the flow of an incompressible fluid in a partially blocked two-dimensional subchannel. A vorticity-stream function formulation with a generalised curvilinear coordinate system is used for a wide range of geometric configurations. The system of coupled, non-linear equations is solved by a block relaxation scheme for which the rate of convergence is substantially increased by a multigrid technique. A number of numerical experiments are described to illustrate the efficiency of the proposed approach. It is then applied to a typical subchannel problem in thermal-hydraulics. (9 refs.)

65540 Numerically induced pressure excursions in two-phase-flow calculations. J.H.Mahaffy, D.R.Liles (Safety Code Dev. Group, Los Alamos Nat. Lab., Los Alamos, NM, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.470-3 vol.1

Pressure spikes that cannot be traced to any physical origin sometimes are observed when standard Eulerian finite-difference methods are used to calculate two-phase-flow transients. This problem occurs with varying frequency in nuclear reactor safety codes such as RELAP, RETRAN, COBRA, and TRAC. These spikes usually result from numerical water packing or from interactions between spatial discretization and heat transfer. (4 refs.)

65541 Application of a Taylor series approximation to represent the heat transfer constitutive relationships in thermal-hydraulic computer codes. S.E.Dingman (Sandia Labs., Reactor Safety Studies Div., Albuquerque, NM, USA), R.A.Nelson.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.474-9 vol.1

A technique for decreasing the computer execution time for convective heat transfer calculations in thermal-hydraulic computer codes is investigated. The technique consists of approximating the convective heat flux by the first-order terms of a Taylor series expansion, with fluid and heat structure conditions as independent variables. The technique was incorporated into the RELAP5 computer code. Calculations were performed to determine the savings in computer-execution time and to verify the accuracy of the approximation. (9 refs.)

65542 Comparison of FEBA test data with RELAP4/MOD6 postcalculations. K.Rust, P.Ihle (Inst. fur Reaktorbauelemente, Kernforschungszentrum Karlsruhe, Karlsruhe, Germany), S.L.Lee.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.731-7 vol.1

The FEBA forced feed reflood experiments included base line tests with unblocked bundle geometry. The experiments consisted of separate effect tests on a full-length 5×5 rod bundle. Selected experimental cladding temperatures and heat transfer coefficients are compared with the analytical data postcalculated by the RELAP4/MOD6 transient analysis code. The comparison gave a 'satisfactory' matching of the peak cladding temperatures, quench times, and heat transfer coefficients at nearly all axial elevations for the flooding velocity and system pressure in the ranges of those FLECHT and semiscale experiments which were used in the code assessment. However, it should be noted that this matching was made possible only by the use of artificially adjusted values of the empirical code input parameters for the water entrainment model and the liquid weighting factor for the dispersed flow regime after the experimental results had already been known. (8 refs.)

65543 Analytical prediction of blowdown system experiments using DRUFAN. A.B.Wahba, K.Wolfert (Gesellschaft fuer Reaktorsicherheit mbH, Garching, Germany), F.Tanabe.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.752-60 vol.2
The significant physical phenomena observed during HDR and Battelle blowdown experiments are correctly predicted by the thermal-hydraulic system code DRUFAN-02. (10 refs.)

65544 An evaluation of water hammer in nuclear power plants. A.W.Serkiz (Div. of Safety Technol., US Nuclear Regulatory Commission, Washington, DC, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.803-6 vol.2
Water hammer can occur as a result of steam-void collapse, steam-driven slugs of water, pump startup into voided lines, and inadvertent closures of valves; the result is large hydraulic pressure loads. Since 1968, about 150 water hammer events have been reported in USA nuclear power plants; damage has been confined to pipe hangers and snubbers. The increase in reported water hammer events in the 1970s led to the designation of water hammer as Unresolved Safety Issue A-1 in 1979. Since the mid-1970s reported occurrences and their underlying phenomena have been studied, and corrective design and operational measures have been implemented. This paper presents the results of generic evaluations of water hammer occurrence and reported damage and sets forth technical findings. These findings indicate that good design practices and operational procedures can minimize the occurrence of water hammer. (6 refs.)

65545 A method for assessing reactor core cooling without forced circulation. Y.Feyginberg, P.Sergejewich, W.I.Midvidy (Nuclear Studies & Safety Dept., Ontario Hydro, Toronto, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.808-17 vol.2
Under some of the postulated accidents of the CANDU PHWR, electrical power to the heat transport (HT) pumps may be interrupted resulting in the loss of forced circulation. Experiments and analyses indicate the existence of two modes of natural circulation which can provide adequate core cooling at decay power levels. These are thermosyphoning (single-phase or two-phase) and intermittent buoyancy induced flow (IBIF). (5 refs.)

65546 Natural circulation in boiling water reactors. J.M.Healzer (S. Levy Inc., Campbell, CA, USA), P.G.Bailey.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.818-24 vol.2
This report describes a study to examine the natural circulation behavior of the boiling water reactor (BWR). In the first part of the study, data have been compared to predictions of natural circulation operating conditions for several BWRs. The second part of the study examines natural circulation operation at low power and reduced inventory conditions such as might occur in the unlikely event of a system isolation followed by failure to make-up water lost due to decay heat boil-off. For this analysis, the same model used earlier to predict power operation at natural circulation is used to demonstrate the low inventory behavior of the BWR. The conclusion of this second part of the study is that the BWR system can sustain substantial inventory loss before it can no longer maintain natural circulation cooling. (5 refs.)

65547 Natural circulation cooling characteristics during PWR accident simulations. J.P.Adams, G.E.McCreery, V.T.Berta (EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.825-32 vol.2
A description of natural circulation cooling characteristics is presented. Data were obtained from several pressurized water reactor accident simulations in the loss-of-fluid test (LOFT) pressurized water reactor (PWR). The reliability of natural circulation cooling, its cooling effectiveness, and the effect of changing system conditions are described. Quantitative comparison of flow rates and time constants with theory for both single- and two-phase fluid conditions were made. It is concluded that natural circulation cooling can be relied on in plant recovery procedures in the absence of forced convection whenever the steam generator heat sink is available. (17 refs.)

65548 Natural-circulation experiments in two SRI/EPRI test facilities. R.L.Kiang, P.R.Jeuck,III (SRI Internat., Menlo Park, CA, USA), J.-P.Sursock.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.833-9 vol.2
Two laboratory-scale facilities, both modeled after pressurized water reactors (PWRs), were tested. The geometry of the low-pressure facility (0 psig) followed the Westinghouse four-loop design; that of the high-pressure facility (100 psig) followed Combustion Engineering's two-loop design. One of the primary objectives of these tests was to study decay heat removal by means of natural circulation. Accordingly, a large amount of natural-circulation data was collected. Thermal-hydraulic responses of the systems under conditions ranging from noncondensable gas injection to forced-to-natural-circulation transitions were also tested. This paper presents data from two specific natural-circulation tests: one with the primary system subcooled, the other under a two-phase condition. Test results demonstrated that natural circulation in the primary loops of these facilities, either single-phase or two phase, is capable of long-term heat removal. The single-phase flow is steady, hence its flow rate is calculable by an energy balance equation. When the primary loop is under a two-phase condition, temperatures at various locations around the loop exhibit unsteady characteristics, which indirectly reflect the unsteadiness of the loop flow. (9 refs.)

65549 Natural circulation cooling in a PWR geometry under accident-induced conditions. D.J.Shimeck, G.W.Johnsen (EG&G Idaho Inc., Water Reactor Res. Test Facility, Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.849-57 vol.2
The characteristics and limits of natural circulation heat rejection over a wide range of conditions were experimentally investigated in a small-scale model of a pressurized water reactor. Conditions that were varied included primary and secondary coolant inventory, decay heat power, and primary noncondensible gas content. The results have defined three distinct modes of natural circulation, their limits and transition points, and the characteristic 'signatures' accompanying natural circulation behavior. Particular emphasis is focused on the limits of natural circulation under severely degraded primary and secondary conditions. (12 refs.)

65550 On natural circulation in high temperature gas-cooled reactors and pebble bed reactors for different flow regimes and various coolant gases. G.Melese d'Hospital (General Atomic Co., San Diego, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.858-66 vol.2
The use of CO_2 or N_2 (heavy gas) instead of helium during natural circulation leads to improved performance in both high temperature gas-cooled reactors (HTGR) and in pebble bed reactors (PBR). For instance, the coolant temperature rise corresponding to a coolant pressure level and a rate of afterheat removal could be only 18% with CO_2 as compared to He, for laminar flow in HTGR; this value would be 40% in PBR. There is less difference between HTGR and PBR for turbulent flows; CO_2 is found to be always better than N_2. These types of results derived from relationships between coolant properties, coolant flow, temperature rise, pressure, afterheat levels and core geometry, are obtained for HTGR and PBR for various flow regimes, both within the core and in the primary loop. (3 refs.)

65551 Reflux condensation in a vertical channel flow. B.K.-H.Sun, M.Toren, Seung Oh (Nuclear Power Div., Electric Power Res. Inst., Palo Alto, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.867-73 vol.2
A simple one-dimensional, two-phase, channel flow model is presented together with numerical results and a comparison with experimental data. The model is based on an integral, modified Nusselt type of energy and momentum balance, taking into consideration interfacial shear and vapor depletion due to condensation. Complete condensation length and flow limitations due to countercurrent flooding are presented for different vapor flow rates and system pressure. These results may be applied to estimate the conditions of occurrence of the reflux condensation mode in steam generator tubes and the associated heat removal capability of pressurized water reactors. (14 refs.)

65552 Degraded cooling in a CANDU. R.A.Brown, C.Blahnik, A.P.Muzumdar (Nuclear Studies & Safety Dept., Ontario Hydro, Toronto, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.884-90 vol.2
Loss-of-coolant accident (LOCA) analysis for a CANDU reactor considers a wide range of postulated break sizes and locations in the heat transport piping. Coincident failure of the emergency coolant injection system to operate on demand must also be considered. This paper describes the unique features of the CANDU core and heat transport system, and how these features affect the response of the system to a LOCA. The possible range of behaviour of the fuel and fuel channels following a LOCA is discussed in terms of the maximum fuel temperature which could occur, and also in terms of the potential for breaching the core pressure boundary (in the case of CANDU, this boundary comprises a large number of horizontal pressure tubes each containing horizontal fuel bundles). It is concluded that fuel temperatures remain well below the UO_2 melting temperatures, and that the integrity of the pressure boundary is maintained, for all postulated LOCAs. (2 refs.)

65553 Dryout of an inductively heated bed of steel particles with subcooled flow from below. F.P.Tsai, J.Jakobsson, I.Catton, V.K.Dhir (School of Engng. & Applied Sci., Univ. of California, Los Angeles, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.891-5 vol.2
An experimental investigation of dryout heat flux in an inductively heated bed of metal particles with forced flow from below has been conducted. The mass flux varied from 0 to 3.11 kg/m^2 sec. Freon-113 was used as coolant. Particle sizes were 1588 μm, 3175 μm, and 4763 μm in diameter. The dryout heat flux was found to increase as mass flux increases. When the mass flux is large enough the dryout heat flux asymptotically approaches the total evaporation energy of the inlet flow. (10 refs.)

65554 Mixed convection of liquid metal in a rectangular cavity. R.Vidil, R.Martin, D.Grand (Service des Transferts Thermiques, Centre d'Etudes Nucleaires de Grenoble, Grenoble, France).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1248-53 vol.2
The basic problem studied is the interaction between a vortex and a thermal stratification. This phenomenon takes place in a rectangular cavity. On its lower side, the cavity communicates with a channel in which forced flow is imposed. Heat is applied to the cavity through the roof. This problem is studied with three different approaches: a computer code and two experiments (one is sodium, the other in water). In the sodium experiment, the governing parameters are prototypic of reactor conditions such as SUPERPHENIX. So this sodium experiment is a benchmark for the validation of other approaches: water test models and computer programs. (3 refs.)

65555 An analytical model for heat transfer in a pin-bundle presentation and first validation. J.-M.Le Gouez (Centre d'Etudes Nucleaires de Cadarache, Saint Paul Lez Durance, France).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1302-9 vol.2
The ANACONDA mathematical model presented is aimed at calculating the three dimensional temperature field inside a LMFBR rod-bundle cooled by forced convection. In this thermal model the cross section of the rod bundle is discretized into a number of fluid and solid regions (pin heating zones, claddings, hexagonal duct). The lateral operators representing transverse energy transport inside the rod bundle (i.e. at a given cross-section) are approximated so as to enable an integration by hand of the thermal balance set of equations without any discrete representation of the axial space or time operators. The

first validation of the model was done through calculating the three dimensional enthalpy field inside a 19 pin bundle, which had been experimentally investigated by the CEA in Grenoble (GR 19I bundle). The model was then used for the preparation of the SCARLET II local porous blockage experiments to the run by EDF at Chatou. (5 refs.)

65556 Semi-empirical model for friction factors in LMFBR wire-wrapped rod bundles. P.Carajilescov (Div. de Engenharia Mecanica Aeronautica, Sao Jose dos Campos, Brazil), E.F.Fernandez.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1318-25 vol.2
A semi-empirical model is developed for subchannel and bundle average friction factors for laminar and turbulent axial flows in wire-wrapped rod arrays. The results of this model are compared to available experimental data and they are considered satisfactory for wide ranges of geometrical parameters. (11 refs.)

65557 Distributed parameter analysis of the thermal-hydraulic behavior of wire wrapped rods in LMFBR cores. M.C.Chuang, M.D.Carelli, M.R.Yeung (Westinghouse Res. Labs., Pittsburgh, PA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1326-37 vol.2
Analytical methods to evaluate in detail the principal thermal-hydraulic parameters of wire-wrapped rods in LMFBR core assemblies are discussed. The features are presented of two computer codes which calculate the coolant temperature and velocity, cladding and fuel temperatures at any radial and circumferential position around the entire rod circumference. They are the FATHOM-360 code which analyzes an inboard rod, and FATHOM-360S for an edge rod. Typical design applications are presented, such as calculation of the 'hot spot factor' effects due to the wire wrap spacing and to eccentric positioning of the fuel pellet within the cladding. Correlations of direct usefulness to the core designer are reported which express the above factors in terms of the rod operating parameters. Results of an extensive verification effort are presented. The codes predictions compare very favorably against experimental data obtained for different geometries and under different environmental conditions. (14 refs.)

65558 Analytical study of laminar buoyant convective flow between vertical parallel plates for various thermal boundary conditions. T.F.Irvine,Jr. (State Univ. of New York, Stony Brook, NY, USA), C.L.Quarini.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1382-90 vol.2
The velocity and temperature profiles for laminar buoyancy and forced convective flows between vertical flat parallel plates are predicted. Specific examples relating to tall narrow channels with forced convection and to closed high aspect ratio cavities, as may be found in proposed active and passive insulation systems for LMFBRs are presented. (8 refs.)

65559 Criterion for the onset of mixed convection in vertical bare and wire wrapped rod bundles. P.D.Symolon (Dept. of Chem. Engng., MIT, Cambridge, MA, USA), N.E.Todreas, W.M.Rohsenow.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1391-402 vol.2
In the LMFBR blanket assembly, large radial power gradients exist which cause buoyancy-induced flow redistribution within the rod bundle. A criterion is developed to predict the onset of mixed convection in vertical bare and wire wrapped rod bundles. The onset of the mixed convection criterion determines when a forced convection analysis is no longer valid, so that a procedure with mixed convection capability must be employed. The criterion is intended for use with existing numerical tools to aid the user in selecting the solution method most appropriate for a given set of operating conditions. (5 refs.)

65560 Finite-element predictions of laminar natural convection in a trapezoidal water-filled plenum and comparison with experiment. P.M.Birchenough (Theoretical Phys. Div., AERE Harwell, Harwell, England), K.H.Winters.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1403-11 vol.2
A finite-element simulation of laminar natural convection of water in a trapezoidal plenum with a sloping cold floor, adiabatic short sidewall, heated long widewall and either heated or adiabatic roof is reported. Results are presented at Rayleigh numbers of 5×10^9 and 2×10^{10}. These are compared with measurements made in a water-filled, 1/22-scale model of the plenum at a higher Rayleigh number of around 10^{12}, and good qualitative agreement is found. Much of the flow is confined to the lower triangular region of the cavity and the upper part is largely stagnant with a high degree of temperature stratification. The effect of an imposed roof flux is to increase the flow stagnation and temperature stratification in this upper part. The Nusselt number varies strongly along the sloping floor and attains a high value at the base of the short vertical wall. (2 refs.)

65561 Instrumentation for measurements in spray experiments. H.J.Richter, S.B.Miller, G.G.C.Durkee (Thayer School of Engng., Dartmouth Coll., Hanover, NH, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1420-6 vol.2
Recent years saw substantial research activity on the subject of Emergency Core Cooling Systems of Light Water Reactors. One area of this research is the study of the behavior of emergency cooling spray nozzles in Boiling Water Reactors. At the start of this program it was not known which information was needed to support the theory. Therefore, attempts were made to measure as many variables as possible in the experiments. Development of new instrumentation was one of the major tasks during this work. New devices were developed to measure water flux as a function of distance from the nozzle, to measure droplet velocity, size and frequency. The development of these devices presents a step towards readily useable measurement devices. Further development is certainly necessary before this goal is achieved. (11 refs.)

65562 An optical probe for interface detection at high pressure (180 bar) and high temperature (360°C) [two-phase flow]. J.M.Delhaye, R.Charlot (Service des Transferts Thermiques, CENG, Grenoble, France), F.Danel, J.Arnault.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1427-30 vol.2
Optical probes have been widely used for about ten years to detect the passage of interfaces at a given point of a gas-liquid two-phase flow. The materials and the design of the probes that have been used so far have prevented their use at temperatures higher than 110°C and/or in severe industrial environments (corrosive fluids, liquids loaded with solid particles, etc.). In order to overcome these drawbacks, sapphire probes have been developed and tested. The authors describe the technology of these new probes and the life tests that they have withstood. (16 refs.)

65563 Three-dimensional density field determination by external stationary detectors and gamma sources using selective scattering. N.Kondic (US NRC, Washington, DC, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1443-55 vol.2
In many fields one needs to know the spatial density distribution; two-phase systems are of particular importance. In particular, gas-liquid mixtures play a role in power generation, chemistry, bio-medicine etc. An intrusion into the measured system is frequently undesired or not permitted. Therefore, external, non-invasive instrumentation has definite advantages. Photon-energy discrimination methods, measuring scattered fluxes, can employ stationary equipment; they need partial collimination or only protective shielding. The results are achieved with a higher information/irradiation ratio than is the case with transmission methods. The utilization of a mesh of isogonic lines (each of them being characterised by its particular scattering angle) has several advantages when compared with the mesh of straight lines ('pencil beams') used in tomography. The ultimate experimental arrangement employing Compton scattering has fan/fan beam geometry, i.e. wide angle emitting and receiving of gammas. The direct result of the measurement is a 'scattergram', i.e., countrate versus scattered energy spectrum. Besides representing the 'signature' of a two- or three-dimensional density distribution, it also enables the reconstruction of local density values. The authors outline the necessary analysis and presents experimental proof of principle. (12 refs.)

65564 Modeling aspects of the PNA technique for flow rate measurements. J.L.Achard (Inst. de Mecanique de Grenoble, Grenoble, France), J.M.Delhaye.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1456-62 vol.2
The Pulsed Neutron Activation (PNA) technique uses a pulsed, external neutron source to induce some activity into a flowing fluid. It can be used to measure mass flow rates of steady single-phase and two-phase flows. A basic case of high interest corresponds to turbulent single-phase flows when the radial velocity profile is approximately flat. Two authors give for this elementary case different data reduction formulas. Kehler (1980) claims that a $1/\tau^2$ weighting technique is appropriate whereas Perez-Griffo et al. (1982) promote a $1/\tau$ technique. The present authors give and justify their own point of view on this controversy. In addition, they indicate how to properly take into account the irradiation of the fluid slab and the detection of the induced activity. (12 refs.)

65565 Experimental and numerical model for annular dispersed downward air/water flow in a venturi. S.El-Haggar, C.T.Crowe (Mech. Engng. Dept., Washington State Univ., Pullman, WA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1463-8 vol.2
The flow of annular-dispersed gas-liquid mixtures through a restriction results in flow characteristics much different than a fully developed annular-dispersed flow in a duct. Experimental studies at Washington State University have shown that pressure drop in a venturi geometry is strongly dependent on the droplet concentration in the core flow and upon droplet size. The experiments were carried out in a downward flow with nominally fifty percent of the liquid flow associated with droplets in the core. Pressure drop measurements were made with different liquid flow rates and venturi geometries. It was found that the standard approach to predict pressure drop using the Lockhart-Martinelli (1949) or Chisholm (1967) correlation is far from adequate for these types of flows. The inadequacy of these empirical correlations has led to the development of a more descriptive numerical model. The model is based on the equations for a quasi one-dimensional flow with suspended water droplets in the gas core and a water layer in the wall. (10 refs.)

65566 LOFT instrumentation: an overview of challenges and developments. D.B.Engelman (Idaho Nat. Engng. Lab., EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1477-82 vol.2
The Loss-of-Fluid Test (LOFT) reactor is an integral test facility, devoted to an investigation of the thermal-hydraulic and fuel behavior of a reactor system during off-normal conditions. The requirement to measure important parameters at many points within the reactor has led to a number of advances in the state-of-the-art of experimental instrumentation as applied to an operating reactor. Since LOFT is an operating nuclear reactor, the instruments must survive full Pressurized Water Reactor (PWR) operating conditions, and be able to measure various off-normal conditions. The instruments developed and applied on LOFT include specialized velocity, density, liquid level, and mass flow instruments, as well as a variety of specialized fuel behavior instrumentation. These instruments have been excellent, both in survivability and production of data. (11 refs.)

65567 Effects of thermocouple installation and location on fuel rod temperature measurements. R.D.McCormick (Idaho Nat. Engng. Lab., EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1483-90 vol.2
Describes the results of analyses of nuclear fuel rod cladding temperature data obtained during in-reactor experiments under steady state and transient (simulated loss-of-coolant accident) operating conditions. The objective of the analyses was to determine the effect of thermocouple attachment method and location on measured thermal response. The use of external thermocouples increased the time to critical heat flux (CHF), reduced the blowdown peak temperature, and enhanced rod quench. A comparison of laser welded and resistance welded external thermocouple responses showed that the laser welding technique reduced the indicated cladding steady state temperatures and provided shorter time-to-CHF. A comparison of internal welded and embedded thermocouples indicates that the welded technique gave generally unsatisfactory cladding temperature measurements. The embedded thermocouple gave good, consistent results, but was possibly more fragile than the welded thermocouples. Detailed descriptions of the thermocouple designs, attachment methods and locations, and test conditions are provided. (2 refs.)

65568 Temperature independent measurement of nuclear fuel rod pressures. T.R.Billeter (EG&G Idaho Inc., Richland, WA, USA), J.C.Lucero.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1506-10 vol.2
The fuel rod plenum gas pressure sensor for Loss-of-Fluid-Test (LOFT) reactor exhibits measurement error when immersed in a dynamic temperature environment. Methods of reducing the error during transients have centered on providing thermal shields around the 500 kHz eddy current type transducer and on modifying the signal conditioning. A cylindrical copper enclosure around the transducer envelope reduced transducer signal response to imposed temperature variations. Signal modification methods employing two excitation frequencies and detection by phase-sensitive techniques proved very effective. Significant reductions of measurement error result from use of the signal compensation technique. Using phase sensitive signal detection, the absolute pressure measurement error is reduced by a factor of at least three as compared with the error in measured pressure as related to the uncompensated signal output. Consequently, the technique is recommended for analysis of signals from LOFT eddy current based pressure transducers. (4 refs.)

65569 Relationship of core exit temperature noise to thermal-hydraulic conditions in PWRs. F.J.Sweeney (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), B.R.Upadhyaya.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1511-18 vol.2
Core exit thermocouple temperature noise and neutron detector noise measurements were performed at the Loss of Fluid Test Facility (LOFT) reactor and a Westinghouse, 1148 MW(e) PWR to relate temperature noise to core thermal-hydraulic conditions. The noise analysis results show that the RMS of the temperature noise increases linearly with increasing core ΔT at LOFT and the commercial PWR. Out-of-core test loop temperature noise has shown similar behavior. The phase angle between core exit temperature noise and in-core or ex-core neutron noise is directly related to the core coolant flow velocity. However, if the thermocouple response time is slow, compared to the coolant transit time between the sensors, velocities inferred from the phase angle are lower than measured coolant flow velocities. The results indicate that core exit temperature noise is a potentially valuable tool for the detection of thermal-hydraulic anomalies such as flow blockages or boiling. (11 refs.)

65570 Nuclear reactor measurements at up to 550°C. A.Goodings (Control & Instrumentation Div., AEE Winfrith, Dorchester, England).
Colloquium on 'High Temperature Electronics', London, England, 23 March 1983 (London, England: IEE 1983), p.6/1-4
The region of interest comprises the moderator, fuel and its associated coolant channels. Details vary with the reactor type and temperatures may vary from a few tens of degrees centigrade (near biological shielding) to of order 1000°C (within the fuel). Coolant outlet temperatures in power producing reactors lie between about 300°C in water systems and 550°C in the Advanced Gas-cooled Reactor and in sodium-cooled reactors. The local atmosphere is coolant at high pressure and sensors must also be able to survive a radiation environemnt of fast and thermal neutrons plus a concomitant gamma flux. In some cases the latter can deposit energy at a rate of order 1 $W.g.^{-1}$ and may lead to substantial temperature rises above local ambient. It is for this reason that 550°C technology is sometimes required in systems with an apparent temperature limit of order 300°C. Neutron flux measurements are usually required for control purposes and it is often necessary to follow a working range of about 9 decades from shutdown to full power. This is necessary for operational reasons but can be difficult with a single type of sensor, particularly since reactor designs often impose limits on possible sensor locations. (8 refs.)

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics .... See Entry 64589

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Density fluctuations in simple stochastic reactor models .... See Entry 65307

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A review of flow-induced vibrations in reactors and reactor components .... See Entry 65312

Laminar flow induced deflections of stacked plates .... See Entry 65315

Calculations of hydrogen detonations in nuclear containments by the random choice method .... See Entry 65316

Operating efficiency of steam separators in power plants with RBMK reactors .... See Entry 65318

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Analysis of PKL Test K9 by THYDE-P Code (CSNI ISP No.10 and THYDE-P sample calculation run 70) .... See Entry 65578

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Thermal-hydraulics of valves for nuclear applications .... See Entry 65582

Applications of the RELAP5 code to the station blackout transients at the Browns Ferry Unit one plant .... See Entry 65583

Analysis of loss of feed water ATWS transients .... See Entry 65584

Analysis of station-blackout-ATWS with respect to surgeline pressure drop .... See Entry 65585

RELAP5/MOD1 analysis of turbine trip test 1 at Peach Bottom Unit 2 .... See Entry 65586

TRAC analysis of steam generator overfill transients for TMI-1 .... See Entry 65587

Simulation of LOFW transient during the TMI-2 accident .... See Entry 65588

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Development of a real time PWR accident simulator and its application for TMI-LOCA analysis .... See Entry 65590

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TRAC analysis of radial power distribution effects on forced-feed reflood experiments .... See Entry 65601

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Analytical study of BWR upper plenum behavior under LOCA by TRAC-BD1 .... See Entry 65604

Posttest analysis of Semiscale Tests S-UT-6 and S-UT-7 using TRAC-PF1 .... See Entry 65605

Large break integral test with the Two Bundle Loop and post-test analysis by RELAP5/MOD1 .... See Entry 65606

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Fuel temperature excursions during accidents with degraded cooling in CANDU reactors .... See Entry 65608

Prediction of critical flow rates through power-operated relief valves .... See Entry 65609

Valve qualification for normal and accident conditions in LWRs .... See Entry 65610

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An analysis of flow induced oscillations in safety valves .... See Entry 65612

A mechanistic hydrodynamics model for the simulation of BWR jet pumps during normal and off-normal operation .... See Entry 65613

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On the growth of large spherical sodium vapor bubbles in a liquid sodium pool .... See Entry 65650

Two-phase, two-component thermohydraulic conditions produced in the vent line of a steam generator following a sodium-water reaction .... See Entry 65652

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Fuel penetration of intersubassembly gaps in LMFBRs (a calculational method with the SIMMER-II code) .... See Entry 65655

Two-dimensional steady-state thermal and hydraulic analysis code for prediction of detailed temperature fields around distorted fuel pins in an LMFBR assembly: SPOTBOW ....See Entry 65656

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Heat transfer by natural convection in sodium from downward facing surfaces ....See Entry 65658

Effects of cladding external thermocouples and electrical heater rod design on quench behavior ....See Entry 65660

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Primary pump power as a measure of fluid density during bubbly two-phase flow ....See Entry 65662

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Forced flow cooling studies of volumetrically heated porous layers ....See Entry 66579

Pressure drop and flow characteristics of two-phase flow in porous media with distinct permeability regions ....See Entry 66626

28.44 FISSION REACTOR PROTECTION SYSTEMS, SAFETY AND ACCIDENTS

65571 A case study on effectiveness of structural reliability analysis in nuclear reactor safety assessment. A.Yamaguchi, S.Kondo, Y.Togo (Dept. of Nuclear Engng., Univ. of Tokyo, Tokyo, Japan).
Reliab. Eng. (GB), vol.5, no.1, p.21-36 (1983).
An effective method for quantitative evaluation of structural reliability based on 'stress strength model' is developed with the objectives of taking a larger number of factors into the evaluation than before and giving useful results within moderate computing time. The method is applied to the reliability analysis of PWR pressure vessels. The results show the relative importance of inspection as well as the parameter uncertainty for assuring the reliability analysis of PWR pressure vessels. The results show the relative importance of inspection as well as the parameter uncertainty for assuring the reliability of the structure, although analysis is limited with the scope of linear elastic fracture mechanics. This case study also shows that the analysis of structural reliability is effective for safety assessment of nuclear power plants in general and possibly for the improvements of the consistency in the design code. (10 refs.)

65572 Simulation experiment of five percent small break loss-of-coolant accident of boiling water reactor. K.Tasaka, Y.Koizumi, Y.Anoda, H.Kumamaru, M.Shiba (JAERI, Ibaraki, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.89-104 (Feb. 1983).
Five-percent small break tests have been conducted at the ROSA-III test facility with various emergency core cooling system (ECCS) actuation conditions. A break was assumed at the main recirculation pump inlet line. No dryout of the fuel surface was observed in tests with a high pressure core spray system (HPCS) actuation irrespective of the conditions of the other ECCS. Without HPCS the whole core was uncovered to the steam environment; however, the peak cladding temperature (PCT) was limited to 1022K, which is well below the present safety criteria of 1473K. The results of the test with the highest PCT without HPCS actuation were analyzed by the RELAP4/Mod6 computer code. The calculated fuel surface temperatures agreed well with measured results in the blowdown phase. (20 refs.)

65573 Propagation of expansion wave in flexible-wall tube. T.Watanabe, H.Mikami (Res. Lab. for Nuclear Reactors, Tokyo Inst. of Technol., Tokyo, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.117-26 (Feb. 1983).
As a model of the fluid-structure interaction which occurs during a loss-of-coolant accident in a pressurized water reactor, the pressure variation in the expansion wave propagating through the flexible-wall tube was measured along with the deformation of the wall. An analysis of the experimentally observed phenomena is performed by solving one-dimensional flow equations coupled with an equation of the wall deformation. The method employed is a numerically stable semi-implicit donor-cell difference method. The rate of pressure decrease was found to be reduced in comparison with the case of the rigid-wall tube. The fluid-structure interaction generates the pressure profile which is regarded as a superposition of the pressure profile of the expansion wave in the rigid-wall tube and the disturbance generated by the deflection of the flexible wall. The vibrations of the pressure and the flexible wall due to the inertia of the wall were also found. Both the damping of the deflection and the wall friction of the structure are found to be important parameters pertinent to the fluid-structure interaction phenomena. (11 refs.)

65574 Integrated solidity test measurement of the airtight compartment system at the nuclear power station in Paks. M.Osztheimer, M.Taubner, Zs.Techy.
Meres & Autom. (Hungary), vol.31, no.1, p.23-8 (1983). In Hungarian.
Gives a brief report on the purpose of the integrated solidity test measurements of the airtight compartment system of the nuclear power station and on the applied measuring principle. The measuring system and the selected measuring methods are evaluated. The characteristic features of the airtight system of the Paks nuclear power station's first block and their effects on the measurement are mentioned. (2 refs.)

65575 Steam generator probe positioning device. M.D.Groves.
Report EPRI-NP-2774, Electr. Power Res. Inst., Palo Alto, CA, USA (Dec. 1982), 42 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
Maintenance of PWR nuclear plant boilers continues to be a major problem in the nuclear power industry. Results are presented of a Phase I feasibility study of a device that would prevent man-rem radiation dosages by eliminating the need for manned entry into the channel head to emplace positioning devices for tubing inspection probes. Developed as part of a series of projects to improve inspection methods for steam generators, the proposed device is discussed in terms of its advantages, offering reduced radiation exposure, shorter inspection time, greater versatility and speed, and less skill and training for the equipment operators.

65576 Full-scale turbine missile casing tests. H.R.Yoshimura, J.T.Schamaun.
Report EPRI-NP-2741, Electr. Power Res. Inst., Palo Alto, CA, USA (Jan. 1983), 196 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
Presents the results of two full-scale tests simulating the impact of turbine disk fragments on simple ring and shell structures that represent the internal stator blade ring and the outer housing of an 1800-rpm steam turbine casing. Structural and finite element analysis and data interpretation, estimates of energy during impact, missile displacement and velocity histories, and selected strain gage data are included.

65577 Test results of a jet impingement from a 4 inch pipe under BWR LOCA conditions. T.Isozaki, T.Yano, N.Miyazaki, R.Kato, R.Kurihara, S.Ueda, S.Miyazono.
Report JAERI-M-82-110, Japan Atomic Energy Res. Inst., Tokai, Ibaraki, Japan (Sept. 1982), 54 pp.
Hypothetical instantaneous pipe rupture is now considered to be one of the design basis accidents during the operation of the light water reactor. If a pipe rupture accident occurs, the pipe will start moving with the sudden discharge of internal fluid. So, the various apparatus such as pipe whip restraints and jet deflectors are being installed near the postulated break location to protect the nuclear power plants against the effect of postulated pipe rupture. Pipe whipping test and jet discharge test are now being conducted at the Division of Reactor Safety of the Japan Atomic Energy Research Institute. The authors describe the test results of the jet discharge from a 4 inch pipe under BWR LOCA condition. In front of the pipe exit the target disk of 1000 mm in diameter was installed. The distance between the pipe exit and the target was 500 mm. 13 pressure transducers and 13 thermocouples were mounted on the target disk to measure the pressure and temperature increase due to jet impingement on the target.

65578 Analysis of PKL Test K9 by THYDE-P Code (CSNI ISP No.10 and THYDE-P sample calculation run 70). S.Kosugi, S.Sasaki, Y.Asahi.
Report JAERI-M-82-115, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Sept. 1982), 69 pp.
An analysis of PKL Test K9 is made by the THYDE-P code. Test K9 is the Standard Problem No.10 of Committee on the Safety of Nuclear Installations (CSNI) in the Nuclear Energy Agency (NEA), OECD. The objective of Test K9 is to investigate gravity-feed refill and reflood processes following a double-ended guillotine break in a cold leg with emergency cooling water being injected into the intact cold legs. THYDE-P is a code to analyze both the blow-down and refill-reflood phases of loss-of-coolant accidents (LOCAs) of pressurized water reactors (PWRs). In this report, calculated results are compared with the experimental data and discussed for the purpose of verification study and model development of THYDE-P. A good agreement with the experimental data was obtained using the best estimate (BE) options. (19 refs.)

65579 LOBI - Influence of PWR primary loops on blowdown. First results. W.L.Riebold, H.Stadtke.
Report EUR 6975 EN, Comm. European Communities, Luxembourg (1983), 67 pp.
The LOBI test facility and the experimental programme are described with particular emphasis on the test facility design rationals and the programme objectives. The future small break test programme and the test facility modifications required for these tests are briefly referred to. The present status of the LOBI project is outlined by summarizing the four test series performed so far which were concerned with large break A1-tests, with small break scoping tests, and with large break A2- and B-tests in the framework of an interim test programme; all these tests were executed with the large downcomer. The fourth series presently being performed is concerned with large break A1-tests with the small downcomer. Analysis results are presented of the comparison between prediction and experimental data of the very first LOBI test A1-04 which was used for a special, blind post-test prediction exercise with international participation (LOBI PREX). (9 refs.)

65580 Simulation of transients in light water reactors—desire and reality. W.Frisch (Gesellschaft fur Reaktorsicherheit, Forschungsgelande, Garching, Germany).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.95-7 vol.4
The area of transients in light water reactors is taken as an example to discuss some essential items concerning the relation between requirements and technical realisation of simulation tasks as well as the interactions between physical modelling and mathematical solution methods. Specific examples mentioned for demonstration are selected from work performed in the Federal Republic of Germany because of the author's easier access to specific details. However, general aspects should also apply to other countries. Examples are taken from the area of nonLOCA-transients, which are characterized by multiple feedback between physical processes and controlling systems. (9 refs.)

65581 Flammability behaviour and pressure development of hydrogen mixtures in containment volumes. M.Hertzberg, K.L.Cashdollar (Pittsburgh. Res. Center, Bur. of Mines, Pittsburgh, PA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.29-37 vol.1
The flammability behaviour of any premixed gas is quantifiable in terms of a limiting mathematical surface in a thermodynamic state-space whose independent variables are the initial compositions, the initial temperature, and the initial pressure. That limiting geometric surface in state-space separates a domain of flame propagation within from a region outside of the mathematical surface where flame propagation is not possible in the normal earthly environment. The region of physical space of concern is the air volume within the containment building of a nuclear reactor. Hydrogen and steam can flow into that air volume as a result of a loss-of-coolant accident similar to the one that occurred at Three Mile Island. The authors present a general review of current knowledge of the 'size' and 'shape' of the flammability surface. (13 refs.)

65582 Thermal-hydraulics of valves for nuclear applications. D.W.Sallet (Dept. of Mech. Engng., Univ. of Maryland, College Park, MD, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.111-34 vol.1
Thermal hydraulic aspects of valves used in nuclear power plants are discussed. Emphasis is given to the review of recent work on safety and pressure relief valves including the presentation of some of the author's own experimental results describing one- and two-phase flow through such valves. Measurements of internal flow fields are presented. Significant flow separation occurs in both the safety and the pressure relief valves. An experimental study using high speed photography to determine vaporization sites in safety valves when the flowing medium is initially a compressed liquid is described. A new method of estimating the observed decrease in valve coefficient when choked vapor flow changes to liquid flow is developed. This method also permits the prediction of the observed dependence of the valve coefficient on the receiver pressure in the choked and unchoked flow regimes. The fluid dynamic phenomena which lead to valve disc vibrations are discussed. (32 refs.)

65583 Applications of the RELAP5 code to the station blackout transients at the Browns Ferry Unit one plant. R.R.Schultz, S.R.Wagoner (Idaho Nat. Engng. Lab., EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.530-6 vol.1
As a part of the charter of the Severe Accident Sequence Analysis (SASA) Program, station blackout transients have been analyzed using a RELAP5 model of the Browns Ferry Unit 1 Plant. The task was conducted as a partial fulfillment of the needs of the US Nuclear Regulatory Commission in examining the Unresolved Safety Issue A-44: Station Blackout. (1) The station blackout transients were examined (a) to define the equipment needed to maintain a well cooled core, (b) to determine when core uncovery would occur given equipment failure, and (c) to characterize the behavior of the vessel thermal-hydraulics during the station blackout transients (in part as the plant operator would see it). (6 refs.)

65584 Analysis of loss of feed water ATWS transients. J.T.Robinson, B.R.Sehgal, N.Todreas (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.537-50 vol.1
Analysis of Anticipated Transients Without Scram (ATWS) forms an important part of the assessment of the safety of Pressurized Water Reactors (PWRs). The loss of feed water anticipated transient, in which the secondary side of the steam generators suffers a boil-off, leads to high temperatures and high pressures in the primary system. The prediction of the course of this ATWS transient is the subject of this paper. A simple computer code based on lumped parameter modeling has been developed to predict the transient pressures and temperatures. The results compare very well with those obtained from the RETRAN code. The computer run time is approximately 1/15th of the transient real time. (7 refs.)

65585 Analysis of station-blackout-ATWS with respect to surgeline pressure drop. H.Fulfs (Inst. fur Anlagentech., GKSS-Forschungszentrum Geesthacht, Geesthacht, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.551-5 vol.1
The analysis is based on a station-blackout transient without scram of a 1300 MW_e PWR reference plant and has been performed with the German plant code ALMOD 3, which special purpose it is to calculate the system behavior during transients with large deviations of process variables from normal operating conditions. The investigations have been restricted to the first 60 seconds of the transient, where the maximum values of system pressure and mass flow through the surgeline and the relief as well as the safety valves occurred. As the geometry of the surgeline is rather complex and two-phase flow has to be expected the item of this study is to quantify the influence of the surgeline pressure loss upon the system behavior. It is found, that—depending on the burn-up status—the peak values of pressure and pressure gradient as well as the behavior of the pressure control system are very sensitive to the used pressure loss coefficients. (7 refs.)

65586 RELAP5/MOD1 analysis of turbine trip test 1 at Peach Bottom Unit 2. J.C.Wells, R.K.House (Intermountain Technol. Inc., Idaho Falls, ID, USA), P.G.Bailey.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.556-61 vol.1
The RELAP5/MOD1, Cycle 14 thermal-hydraulics code was used for analysis of turbine trip transient 1 (TT1) conducted at Peach Bottom Atomic Power Station Unit 2. The goals were to evaluate the capability of RELAP5/MOD1 for BWR plant transient analysis and to evaluate the adaptability of RETRAN input models for use in RELAP5. The RELAP5/MOD1 input model used in the evaluation was derived from an existing RETRAN input model of Peach Bottom. Alteration of the RETRAN input model was required because of differences between the codes. Modification of the RELAP5/MOD1, Cycle 14 code was also required to permit effective modeling of jet pumps and the steam separator. The results obtained with the RELAP5/MOD1, Cycle 14 code were in good agreement with the test data. Additional RELAP5 calculations were performed to determine the sensitivity of the results to variations in selected input parameters. (6 refs.)

65587 TRAC analysis of steam generator overfill transients for TMI-1. B.Bassett (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.562-70 vol.1
A reactor safety issue concerning the overfilling of once-through steam generators leading to combined primary/secondary blowdown has been raised recently. A series of six calculations, performed with the LWR best-estimate code, TRAC-PD2, on a Babcock & Wilcox Plant (TMI-1), was performed to investigate this safety issue. The base calculation assumed runaway main feedwater to one steam generator causing it to overfill and to break the main steam line. Four additional calculations build onto the base case with combinations of a pump-seal failure, a steam-generator tube rupture, and the pilot-operated relief valve not reseating. A sixth calculation involved only the rupture of a single steam-generator tube. The results of these analyses indicate that for the transients investigated, the emergency cooling system provided an adequate make-up coolant flow to mitigate the accidents. (3 refs.)

65588 Simulation of LOFW transient during the TMI-2 accident. J.Kornfilt, J.C.Lee, W.R.Martin (Dept. of Nuclear Engng., Univ. of Michigan, Ann Arbor, MI, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.571-7 vol.1
A computer model to simulate the transient behavior of a nuclear steam supply system (NSSS) for a pressurized water reactor has been developed. This plant model incorporates the detailed non-linear steam generator model contained in the TRANSG-1 code along with models for the remaining NSSS components. The overall model, incorporated as the TRANSG-P code, has been used to analyze the plant response in the first thirty seconds of the Three Mile Island Unit 2 (TMI-1) accident. The flow channel and pressurizer models were verified by simulating the transient behavior of a once-through boiling channel test and a pressurizer transient, respectively. The entire plant model of the TRANSG-P code was then used to simulate the NSSS performance for the loss-of-feedwater flow transient at the start of the TMI-2 accident. A comparison of the calculated results with the available data leads to the conclusion that the code is capable of simulating severe transients with reasonable accuracy. (17 refs.)

65589 Loss-of-Fluid Test findings in pressurized water reactor core's thermal-hydraulic behavior. M.L.Russell (EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.578-87 vol.1
Summarizes the pressurized water reactor (PWR) core's thermal-hydraulic behavior findings from experiments performed at the Loss-of-Fluid Test (LOFT) Facility at the Idaho National Engineering Laboratory. The potential impact of these findings on the safety and economics of PWR's generation of electricity is also discussed. Reviews of eight important findings in the core's physical behavior and in experimental methods are presented with supporting evidence. (22 refs.)

65590 Development of a real time PWR accident simulator and its application for TMI-LOCA analysis. H.Yoshikawa, J.Wakabayashi, K.Tokura, K.Ito (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.595-603 vol.1
A fast-running (faster-than-real-time) PWR accident simulator program TOKRAC has been developed which is capable of tracing a long-time transient such as small-break LOCA. TOKRAC consists of two calculational modules: primary loop fluid dynamics and reactor core thermal analysis. The former is based on a single loop, one-dimension homogeneous flow model, while the latter is based on a single channel model. The fast-running capability of TOKRAC is, in addition to the above-mentioned model simplification, improved by using some numerical techniques to reduce calculational steps in both modules, and by replacing key plant variable(s) as externally given input. The calculation accuracy and fast-running capability were checked by applying TOKRAC for a simulation of TMI-2 accident. The comparison of the TOKRAC calculation with predictions by other codes and the actual plant record revealed that TOKRAC well predicts the major events with a computer time much faster than the real physical time. (10 refs.)

65591 Total nuclear plant simulation in real time. P.W.Wyatt, S.Kumar (Westinghouse Electric Corp., Pittsburgh, PA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.604-12 vol.1
The importance attached to nuclear safety analysis has led to the development of many large, sophisticated thermal-hydraulics codes. These codes, however, are in general, not suitable for use with the small computers used in reactor simulator application. They cannot operate in real time on such machines. But the need to respond to increasing demands for simulation fidelity and the upgrading of the simulator from a training device to an engineering tool necessitate a new approach to simulator modeling. The modeling is now required to increase in sophistication such that two-phase flow, reverse flow, stratification, condensation, evaporation, water hammer, and natural circulation are described by incorporating a small thermal-hydraulics code in the simulator. Various analytical techniques are used to run in real time with a minimum of nodes. Such a drift-flux model of the reactor coolant system, steam generators and steam header, plus associated auxiliary systems, is described. (8 refs.)

65592 Pre-test prediction of the TMI-1 turbine trip start-up test transient. P.S.Smith (GPU Nuclear Corp., Parsippany, NJ, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.613-22 vol.1
In support of the power escalation testing program leading to the restart of Three Mile Island Unit 1 (TMI-1), several analyses were performed using the RETRAN thermal hydraulics code. These analyses provided predictions for the plant response during the tests and served to aid in training of the plant operators and plant staff. This paper describes the analyses conducted to predict the plant response to a turbine trip from full power. (4 refs.)

65593 Unmitigated boron dilution events in a PWR. R.J.Henninger, S.B.Woodruff (Energy Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.623-30 vol.1
Dissolved boron is required for control of reactivity in a pressurized water reactor that is shut down. TRAC-PF1 calculations for a typical PWR for vessel-closed and vessel-open configurations show that a high-power excursion (approaching 20% of nominal operating power) is possible if dilution of the boron solution occurs. The calculations also show that sufficient heat capacity exists in the primary system to prevent a large temperature increase and that natural circulation flow of high concentration boron solution from the primary system into the core region will terminate the excursion. (2 refs.)

65594 Effects of the reactor coolant pumps after a small break in a Westinghouse reactor. J.L.Elliott (Energy Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.631-5 vol.1
TRAC-PD2 calculations indicate that more liquid remains in the system when the reactor coolant pumps are left in operation following a 4-inch-diameter cold-leg break in a Westinghouse plant. The analyses were performed to help determine whether to trip the pumps at high-pressure injection initiation, to trip the pumps at some later time in the transient, or to leave the pumps operating indefinitely. The loop seals behavior and the system refill characteristics led to a lower system mass when the pumps were tripped at HPI initiation. No cladding temperature increase occurred in any transient analyzed, however. (no refs.)

65595 Reflood experiments in the REWET-II rod bundle facility including comparisons with computer calculations. T.Kervinen (Nuclear Engng. Lab., Tech. Res. Centre of Finland, Helsinki, Finland), A.Hamalainen, J.Miettinen.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.638-45 vol.1
A series of reflooding experiments has been carried out in the REWET-II facility. The primary objective of these tests was to study the effect of the combined upper plenum and downcomer coolant injection and to provide data for verification of computer codes. The experimental results indicate that upper plenum injection alone cools test rods slowly, a combined coolant injection to the upper plenum and the downcomer improves cooling significantly, and downcomer injection alone cools the test rod bundle best if the total coolant flow rate is the same in these three different cases. In all of these cases the lower plenum was full of coolant at the start of the experiment. Quenching time and clad temperature histories calculated with the computer codes NORCOOL-I and FLOOD4 are in reasonable quantitative agreement

with experiments in the case of pure downcomer injection. Qualitative trends were reasonably predicted in other cases, too. (6 refs.)

65596 FLECHT-SEASET 21-rod bundle flow blockage heat transfer during reflood. M.J.Loftus, L.E.Hochreiter, N.Lee (Westinghouse Nuclear Technol. Div., Pittsburgh, PA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.646-56 vol.1
The effect of various flow blockage shapes and distributions during a PWR reflood was investigated using six 21-rod bundles with full length, internally heated, cosine power-shaped electrical rods. The flow blockage shapes, simulating the fuel rod clad ballooning, were made of thin-wall stainless steel tubes hydroformed into a short, concentric shape and long, nonconcentric shape. The blockage sleeves were distributed both coplanar, with all sleeves located at the same elevation, and noncoplanar. The initial and boundary conditions were varied to include parametric effects of pressure, inlet water temperature, and primarily, flooding rate. The initial mid-plane rod temperature was 871°C (1600°F) in all tests. (12 refs.)

65597 Investigation of radial power and temperature effects in large-scale reflood experiments. F.Motley (Energy Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.657-63 vol.1
The largest reflood test facility in the world has been designed and constructed by the Japan Atomic Energy Research Institute. The experimental test facility, known as the Cylindrical Core Test Facility, models a full-height core section and the four primary loops of a Pressurized Water Reactor. The radial power distribution and temperature distribution were varied during the testing program. The test results indicate that the radial effects, while noticeable, do not appreciably alter the overall quenching behavior of the facility. The Transient Reactor Analysis Code (TRAC) correctly predicted the experimental results of several of the tests. The code results indicate that the core flow pattern adjusts multi-dimensionally to mitigate the effects of increased power or stored energy. (4 refs.)

65598 Fluid dynamic effects in the fuel element top nozzle area during refilling and reflooding. A.Hawighorst, H.Kroning, F.Mayinger (Inst. fur Verfahrenstech., Univ. Hannover, Hannover, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.664-73 vol.1
At an unheated 4×4 rod bundle air/water test facility optical investigations of the entrainment behavior and counter current flow experiments were performed with a large variety of test conditions. It was found that the type of injection has only a weak influence whereas the geometrical conditions upstream of the narrowest flow area (presence of bundle, grid spacer) have an important effect on the flooding behavior. In addition a comparison of the applicability of different flooding models shows that only the models based on dimensionless numbers expressed by superficial velocities, show a good agreement with the own experimental data. (21 refs.)

65599 The effect of inlet flow oscillations on reflooding of a tubular test section. S.Oh, S.Banerjee, G.Yadigaroglu (Dept. of Chem. & Nuclear Engng., Univ. of California, Berkeley, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.674-80 vol.1
The reflooding of a vertical channel under oscillatory inlet flow conditions has been investigated experimentally. Compared to constant injection, oscillations always increase the liquid carryover in the early stages of reflooding. As reflooding progresses, the enhancement diminishes. The crossover point roughly coincides with saturation of the liquid at the quench front (QF). The higher liquid carryover at the beginning increases downstream heat transfer and speeds up QF propagation. But this higher liquid carryover, in turn, reduces the test section mass accummulation rate and delays QF propagation at later stages. The enhancement of liquid carryover, and the early increase and subsequent decrease in quench velocity are all accentuated as the oscillation amplitude and frequency increase. Large amplitude oscillations change the characteristics of QF propagation and the heat transfer immediately downstream of QF substantially. Correlations based on constant-injection reflooding data are not adequate, even if they are applied on an average local-conditions basis. (16 refs.)

65600 Condensation effects in large scale BWR safety experiments. W.A.Sutherland (General Electric Co., San Jose, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.681-9 vol.1
Experiments addressing thermal hydraulic phenomena under Loss-of-Coolant-Accident (LOCA) conditions have been conducted in a full scale 30 degree sector mock-up of the Boiling Water Reactor (BWR). The test program included both steady pressure and transient LOCA simulation, at system pressure up to ten atmospheres, and covered both specific thermal hydraulic phenomena and system response under blowdown/refill/reflood conditions. Condensation effects observed in these experiments contributed to the effective system refill/reflood performance. Two condensation effects of particular interest are core spray injection leading to localized subcooling in the upper plenum that breaks down counter-current flow limiting at the top of the core, and low pressure coolant injection leading to subcooling in the lower plenum that reduces liquid flow out the jet pumps. Both of these effects augment plenum refill and core reflood. (12 refs.)

65601 TRAC analysis of radial power distribution effects on forced-feed reflood experiments. R.K.Fujita (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.690-4 vol.1
TRAC thermal-hydraulic computer program predictions were compared with transient forced-feed reflood experiments. Three forced-flooding, large-scale reflood tests were analyzed to investigate the effect of the radial power distribution on the reflooding behavior of an electrically heated core. TRAC predicted the trends of the data quite well, including the multidimensional hydraulic effects observed in the tests. The variations in the radial power profile did not significantly affect the overall quenching of the core. (no refs.)

65602 Two fluid modelling of the LWR core uncovery transients. C.K.Tsai, B.R.Sehgal, M.S.Kazimi (Dept. of Nuclear Engng., MIT, Cambridge, MA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.695-704 vol.1
The core uncovery (boil-off) transient was studied with a two fluid model for two-phase flow. The objective was to delineate the effects of thermal and mechanical nonequilibrium and multidimensional geometry on the prediction of the two-phase mixture level. Analyses of three sets of experiments (FLECHT-SEASET, Westinghouse 336-rod bundle and semiscale TMI-2 simulation) were performed with the MIT developed two fluid model code THERMIT. It was found that differences in the interfacial momentum-exchange models employed greatly affected the predicted time variation of the two-phase level during the transient. The influence of the thermal nonequilibrium was not as great. The results also showed only small differences between the three-dimensional and one-dimensional calculations for the PWR geometry. (25 refs.)

65603 Application of analytical capability to predict rapid cladding cooling and quench during the blowdown phase of a large break loss-of-coolant accident. S.N.Aksan (Swiss Federal Inst. for Reactor Res., Wuerenlingen, Switzerland), E.L.Tolman, P.A.Nelson.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.705-12 vol.1
Large-break experiments L2-2 and L2-3 conducted in the loss-of-fluid test (LOFT) facility experienced core-wide rapid quenches early in the blowdown transients. To further investigate rapid cladding quenches, separate effects experiments using Semiscale solid-type electric heater rods were conducted in the LOFT test support facility (LTSF) over a wide range of inlet coolant conditions. The analytical capability to predict the cladding temperature response from selected LTSF experiments estimated to bound the hydraulic conditions causing the LOFT early blowdown quenches was investigated using the RELAP4 computer code and was shown to be acceptable over the film boiling cooldown phase. This analytical capability was then used to investigate the behavior of nuclear fuel rods under the same hydraulic conditions. The calculations show that under rapid cooling conditions the behaviors of nuclear and electrical heater rods are significantly different because the nuclear rods are conduction limited, while the electrical rods are convection limited. (20 refs.)

65604 Analytical study of BWR upper plenum behavior under LOCA by TRAC-BD1. N.Abe, M.Katoh (Nuclear Res. Lab., Nippon Atomic Industry Group Co. Ltd., Tokyo, Japan), H.Nagasaka, H.Aoki.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.713-17 vol.1
Describes analytical results of BWR upper plenum behavior under LOCA using the TRAC-BD1 code and comparisons with ESTA (eighteen degrees sector test apparatus) results. TRAC-BD1 is a best estimate system code and features a three dimensional treatment of the BWR pressure vessel and one dimensional treatment of fuel bundles and pipings. ESTA is the LOCA refill-reflood test facility which mocks up an 18 degrees sector of the BWR with full height from jet pump bottom to standpipe top. Analyses of ESTA saturated CCFL test and subcooled CCFL breakdown tests are performed by using the TRAC-BD1 code with special emphasis on multidimensional nonequilibrium two phase flow behavior in the upper plenum associated with CCFL and CCFL breakdown at the upper tie plate. It is confirmed that TRAC-BD1 can predict not only the multi-bundle saturated CCFL characteristics but the effect of spray temperature on CCFL breakdown qualitatively. (2 refs.)

65605 Posttest analysis of Semiscale Tests S-UT-6 and S-UT-7 using TRAC-PF1. B.E.Boyack (Safety Code Dev. Group, Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.718-25 vol.1
A posttest study of Semiscale Tests S-UT-6 and S-UT-7 has been completed to assess TRAC-PF1 predictions of pressurized water-reactor (PWR) small-break transients. The comparisons of the TRAC calculations and experimental results show that the correct qualitative influence of upper-head injection was predicted. The major phenomenological difference was the underprediction of break flow during subcooled and two-phase blowdown. (8 refs.)

65606 Large break integral test with the Two Bundle Loop and post-test analysis by RELAP5/MOD1. T.Matsumoto, M.Murase, M.Naitoh (Energy Res. Lab., Hitachi Ltd., Ibaraki, Japan), T.Gomyoo.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.726-30 vol.1
Simulation tests of a BWR loss of coolant accident (LOCA) were conducted in the Two Bundle Loop (TBL) to obtain blowdown and emergency core cooling (BD/ECC) data and evaluate the parallel channel effect with different bundle powers. The simulations indicated that the flow paths for falling water and updraft steam were separated in the two bundles after the termination of the lower plenum flashing. The flow separation was induced by counter current flow limitation (CCFL) at bundle inlets and outlets. The heatup initiation of rods was early and localized in the bundle with much falling water, while it was delayed in the bundle with much updraft steam. Post test analysis was performed using RELAP5/MOD1 to evaluate its capability for prediction of transient responses in the two bundles. (8 refs.)

65607 An experimental study of blowdown thrust and jet forces by 6-inch pipe under BWR LOCA. T.Yano, T.Isozaki, S.Ueda, N.Miyazaki, R.Kurihara, R.Kato, S.Miyazono (Div. of Nuclear Safety Res., JAERI, Ibaraki-ken, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.761-8 vol.2
The blowdown thrust and jet impingement forces are examined simultaneously in the jet discharge tests relating to the instantaneous pipe rupture accident. The tests were performed with a 6-inch pipe under the BWR LOCA conditions. The initial pressure of the hot saturated water was 6.86 MPa. The following items are made clear: (1) the time history of the blowdown thrust force just after the break, (2) the jet thrust parameter of the pipe, (3) the jet impingement force, (4) the pressure and temperature distributions of the impinging jet and (5) the relationship between the thermalhydraulic quantities and the thrust forces. (11 refs.)

65608 Fuel temperature excursions during accidents with degraded cooling in CANDU reactors. A.P.Muzumdar, C.Blahnik, J.H.K.Lau, G.H.Archinoff (Nuclear Studies & Safety Dept., Ontario Hydro, Toronto, Ontario, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.896-903 vol.2
Describes the methods employed to derive conservative fuel temperature transients during degraded cooling scenarios in CANDU reactors, and presents examples of the results obtained. The analysis is performed using an axially segmented fuel channel model with the fuel bundle assemblies represented by a ring model. All basic modes of heat transfer in a steam environment are accounted for, but no undue credit is taken for heat removal from the fuel. For example, in a loss-of-coolant scenario coincident with a loss of emergency injection, a steam flow rate is defined which maximizes the exothermic Zircaloy-water reaction, while minimizing convective heat removal from the fuel. Other relevant phenomena, such as the effects of geometry distortion on heat transfer paths are also accounted for. It is shown that the moderator acts as an effective heat sink that limits fuel temperatures to well below the melting point of UO$_2$. (4 refs.)

65609 Prediction of critical flow rates through power-operated relief valves. D.Abdollahian (S. Levy Inc., Campbell, CA, USA), A.Singh.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.912-18 vol.2
Existing single-phase and two-phase critical flow models are used to predict the flow rates through the power-operated relief valves tested in the EPRI Safety and Relief Valve test program. For liquid upstream conditions, Homogeneous Equilibrium Model, Moody (1965), Henry-Fauske (1971) and Burnell (1947), two-phase critical flow models are used for comparison with data. Under steam upstream conditions, the flow rates are predicted either by the single-phase isentropic equations or the Homogeneous Equilibrium Model, depending on the thermodynamic condition of the fluid at the choking plane. The results of the comparisons are used to specify discharge coefficients for different valves under steam and liquid upstream conditions and to evaluate the existing approximate critical flow relations for a wide range of subcooled water and steam conditions. Some widely used simplified correlations to predict steam discharge flow rates through values are also evaluated against the data and other models. (12 refs.)

65610 Valve qualification for normal and accident conditions in LWRs. B.Dernbach, K.Riedle, U.Simon (Kraftwerk Union AG, Erlangen, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.919-28 vol.2
Following a brief description of KWU's valve testing facilities the experimental qualification of safety and relief valves for BWRs and PWRs is presented. Both are pilot operated valves and were originally designed for steam flow but have to function also for water and two-phase flow under accident conditions. The tests showed excellent operability of the valves with steam flow. With water the required function was achieved after modifying the cross section and the pressure drop from and to the control volume in the main valves. (3 refs.)

65611 On the stability of a coupled safety valve-piping system. A.Singh (Electric Power Res. Inst., Palo Alto, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.929-37 vol.2
Spring-loaded self-actuating safety valves are employed as part of the overpressure protection systems in various industrial applications. Some safety valve installations may consist of an upstream piping connecting the valve to the vessel and a downstream discharge piping. The effect of these piping systems on the valve performance, especially with regard to the stability on valve opening and closing are investigated in the present study. Possible mechanisms for valve instability are identified based on the pressure fluctuations upstream and downstream of the valve caused by the valve opening and closing. A simplified method to evaluate the magnitude of upstream pressure fluctuations in a constant area pipe and for steam discharge conditions is presented and shown to predict the available data conservatively. Simplified criteria for the valve stability during opening and closing are defined using the predicted upstream pressure fluctuation. (4 refs.)

65612 An analysis of flow induced oscillations in safety valves. K.S.Howe (Westinghouse Electric Corp., Pittsburgh, PA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.938-44 vol.2
A dynamic spring loaded safety valve model has been developed which is coupled to a one dimensional hydraulic code. The two dimensional flow equations are transformed into one dimensional equations with a two dimensional auxiliary equation to correct for the pressure gradient. This model has been applied to valve opening problems under either steam or water conditions. Sample test comparisons with EPRI test program data are included along with a short parametric study. (6 refs.)

65613 A mechanistic hydrodynamics model for the simulation of BWR jet pumps during normal and off-normal operation. J.W.Spore (EG&G Services Inc., Idaho Falls, ID, USA), L.Greenley.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.945-55 vol.2
A mechanistic hydrodynamics model of a BWR jet pump has been developed and tested in CDC's version of the RELAP5/MOD1 computer program. The model has been tested against 1/6th scale single-phase and two-phase data and against full-scale jet pump data. The data comparisons indicate that the model represents well the relevant hydrodynamic phenomena that occurs in a BWR jet pump during normal and off-normal operation. (8 refs.)

65614 Experimental study of two-phase, two-component flow in centrifugal pumps. J.J.Manzano-Ruiz (EPIG Section, INTEVEP, Miranda, Venezuela), D.G.Wilson.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.956-64 vol.2
A test rig was built to run steady-state experiments with air/water mixtures at low pressure (42 kPa), and to determine the performance characteristics of two-phase flow through a centrifugal pump. The present work would find its application in a possible loss-of-coolant-accident situation in nuclear-reactor power plants, if a large break in one of the primary-pump legs takes place. Two feasible accident conditions were tested; they are called first- (forward flow and rotation) and third-quadrant (reverse flow and rotation) conditions. A significant head-pump degradation process was observed in the first-quadrant operation for increasing amounts of gas supplied, whereas in the third quadrant no difference in performance was detected with respect to single-phase flow and up to an inlet volumetric quality of 20%. The data gathered have been correlated in terms of a defined head-loss ratio, flow coefficient and volumetric quality, which facilitates its use in predicting pump performance in similar designs of different scale. (30 refs.)

65615 FRAP-T6 uncertainty study of LOCA tests LOFT L2-3 and PBF LLR-3^a. R.Chambers, W.E.Driskell, S.C.Resch (Idaho Nat. Engng. Lab., EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.965-71 vol.2
Presents the accuracy and uncertainty of fuel rod behavior calculations performed by the transient Fuel Rod Analysis Program (FRAP-T6) during large break loss-of-coolant accidents. The accuracy of the code was determined primarily through comparisons of code calculations with cladding surface temperature measurements from two loss-of-coolant experiments (LOCEs). These LOCEs were the L2-3 experiment conducted in the Loss-of-Fluid Test (LOFT) Facility and the LOFT Lead Rod 3 (LLR-3) experiment conducted in the Power Burst Facility (PBF). Uncertainties in code calculations resulting from uncertainties in fuel and cladding design variables, material property and heat transfer correlations, and thermal-hydraulic boundary conditions were analyzed. Overall, heat transfer correlations and coolant boundary conditions were much more important than fuel rod input parameters in contributing to uncertainties in fuel temperature calculations. Coolant enthalpy was by far the largest contributor to calculation uncertainty. (28 refs.)

65616 Ring grid spacer pressure loss: experimental study and evaluation method. A.Ito, K.Mawatari (Toshiba Corp., Kawasaki, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.972-8 vol.2
For lack of correlation between grid spacer pressure loss and S_g/S_f, H_g/D_g, spacer element location in the flow cell and spacer element edge shape, it is impossible to design a grid spacer whose pressure loss is as low as that for the wire spacer. For work and assembly ease, the ring grid spacer was selected as a candidate for an LMFBR low pressure loss grid spacer. A series of hydraulic experiments were carried out to study the pressure loss characteristics for ring grid spacers with 0.11, 0.18 and 0.21 mm thick grid elements, 5, 10, 15 and 20 mm grid element heights, and 7°, 15° and 30° outer/inner taper angles on both grid element edge corners. To consider strength and pressure loss, desirable ring grid spacer design is $H_g/D_g \approx 15$, $S_g/S_f \approx 0.8$, $\theta \approx 7°$. (15 refs.)

65617 Flow behavior in a stationary vane centrifugal separator—simulation experiments and analysis. S.P.Kalra (Safety & Analysis Dept., Electric Power Res. Inst., Palo Alto, CA, USA), L.S.Yao, W.E.R.Davies.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.979-87 vol.2
The liquid and vapor phase distributions in a scaled model of a static vane centrifugal separator were studied. A range of two-phase loading conditions were simulated in an air-water loop facility. The measurements of local velocities and voids were performed. High-speed flow visualization has been applied in order to provide feedback to the model and analytical tool development. The flow behavior sensitivity on the efficiency of separator is discussed. (6 refs.)

65618 Numerical simulation of thermal and fluid mixing in the cold leg and downcomer of a model geometry during a PWR primary side overcooling. Ching-Lu Lin, J.H.Kim, B.K.H.Sun (Electric Power Res. Inst., Palo Alto, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.988-96 vol.2
The thermal and fluid mixing in the cold leg and downcomer is investigated by using the COMMIX-1A computer code. The code prediction is compared with test data obtained in a model test geometry. The code prediction is shown to agree reasonably well with the test results. The mixing is shown to be enhanced as the loop flow to HPI flow ratio increases. At low loop flow to HPI flow ratio, it is shown that it takes a long time to reach the final steady-state equilibrium. The thermal transient in the downcomer is shown to be very mild everywhere throughout the period considered. (9 refs.)

65619 Thermal-hydraulic analysis of main-steam-line-break accidents as potential initiators for reactor vessel pressurized thermal shock. D.Lamkin (Energy Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.997-1005 vol.2
Results are presented from two thermal-hydraulic analyses of postulated main-steam-line breaks for the Oconee nuclear power plant. One calculation assumes runaway feedwater supply, whereas normal feedwater management is used in the other. The analyses were performed with the TRAC-PD2 code. The objective was to provide primary coolant temperature and pressure histories to assist in evaluating possible reactor-vessel pressurized-thermal-shock concerns. (3 refs.)

65620 Thermal-hydraulic analyses of pressurized-thermal-shock-induced vessel ruptures. D.Dobranich (Energy Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1006-11 vol.2
A severe overcooling transient was postulated to produce vessel wall temperatures below the nil-ducility transition temperature which, in conjunction with system repressurization, led to vessel rupture at the core midplane. Such transients are referred to as pressurized-thermal-shock transients. A wide range of vessel rupture sizes were investigated to assess the emergency system's ability to cool the fuel rods. Ruptures greater than approximately 0.015 m^2 produced flows greater than those of the emergency system and resulted in core uncovery and subsequent core damage. (4 refs.)

65621 Stability analyses of boiling water systems and steam generators. J.Kornfilt, J.C.Lee (Dept. of Nuclear Engng., Univ. of Michigan, Ann Arbor, MI, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1012-19 vol.2
The thermal-hydraulic codes TRANSG-1 and TRANSG-P have been used in the analysis of density wave oscillations (DWOs), which are among the most common of two-phase flow instabilities. The fluid flow model is based on one-dimensional nonlinear, single-fluid conservation equations of mass, momentum and energy, which are solved through an implicit finite-difference formulation. Simulation of DWOs in both once-through and natural-circulation boiling channels with the steam generator code TRANSG-1 indi-

cates good agreement with the test data. The pressurized water reactor system code TRANSG-P was used to simulate an overload condition for the D.C. Cook Unit 1 system. The primary loop was seen to have a negligible effect on the DWOs occurring in the steam generator. Comparisons of the TRANSG-1 and TRANSG-P simulations with simple linearized models led to the conclusion that the main mechanism behind DWOs in both once-through and natural-circulation boiling channels consists of delayed effects and the hydrodynamics boundary condition imposed on the channels. (17 refs.)

65622 Characteristics of PWR ice condenser containment during degraded core and full core meltdown accidents. J.W.Yang, W.T.Pratt (Dept. of Nuclear Energy, Brookhaven Nat. Lab., Upton, NY, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1022-30 vol.2
A study of hydrogen combustion and debris/water interactions in a Pressurized Water Reactor (PWR) ice condenser containment during postulated degraded core and full core meltdown accidents is presented. The study covers a wide range of accident sequences initiated by small break LOCA and transients. The MARCH computer code, with BNL modifications is used in the analysis. The results show that if hydrogen burning can be assured at low concentration, then containment failure is unlikely during the degraded core accidents considered. However, simultaneous hydrogen burning and debris/water interaction at vessel failure during full core meltdown accidents do potentially present a severe threat to the containment integrity. (9 refs.)

65623 The effect of steam bypass on ice condenser containment pressurization. G.A.Pertmer, K.K.Almenas, H.Dezfuli, Z.Jin (Nuclear Engng. Program, Univ. of Maryland, College Park, MD, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1031-8 vol.2
The PWR ice condenser containment utilizes a large mass of stored ice for pressure suppression after an accident. The containment has a smaller volume and a lower design pressure than a comparable PWR dry containment. In this study, the effect on containment pressurization due to steam bypassing the ice bays is analyzed. The CONTEMPT4 code, modified to include an implicit compartment mass transfer algorithm, is utilized. A seven compartment noding of an ice condenser containment is used, and active (sprays and heat exchangers) and passive (concrete and steel) heat sinks are modelled. Results are presented and analyzed for two primary system break sizes and three bypass leakage areas. (7 refs.)

65624 Containment response analysis in TRAC-BD1/MOD1. D.D.Taylor, M.M.Giles, W.L.Weaver,III (Code Dev. Div., EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1039-45 vol.2
The Boiling Water Reactor (BWR) version of the Transient Reactor Analysis Code (TRAC) is under development at the Idaho National Engineering Laboratory to provide an advanced best-estimate predictive capability for the analysis of postulated accidents in BWRs. The code now incorporates a containment thermodynamic response option whereby time-dependent fluid temperatures and pressures in the containment are estimated in order to supply boundary conditions for the primary cooling loop calculation. Implementation and details of the containment model are described herein. Comparisons of the TRAC predictions of containment fluid temperature and pressure response with data from three blowdown test facilities are presented. (6 refs.)

65625 Calculation of the thermal-hydraulic transient in multicompartment systems, by ARIANNA computer codes. N.Cerullo, M.Mazzini, F.Oriolo, S.Paci, A.Pasculli (Univ. of Pisa, Pisa, Italy), R.Romanacci.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1046-51 vol.2
A research program on the behaviour of containment systems has been carried out for a long time at the Istituto di Impianti Nucleari of the University of Pisa (IIN-Pisa), to set up a calculation model adequate for the analysis of the thermal-hydraulic transient following a LOCA. A computer code family, named ARIANNA, has been developed for this purpose. In order to verify and compare ARIANNA's modelling, the IIN-Pisa took part in the international exercises, sponsored by OECD-CSNI: Numerical Benchmark Problem and Containment Standard Problem (CASP) no.1, 2 and 3 The results of the authors' experience are presented and briefly analyzed. (8 refs.)

65626 Containment code verification by systematic evaluation of experimental data. H.B.Schwan (Inst. fur Anlagentech., GKSS-Forschungszentrum Geesthacht, Geesthacht, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1052-7 vol.2
Since 1970 experimental research focused on containment responses due to Loss of Coolant Accidents has been initiated by the Federal German Ministry of Research and Technology. These experiments—performed at several institutions—till now yielded confirmatory as well as unexpected data which gave rise to containment code improvement. Whereas the basic physical equations are common to all containment codes, separate effects as junction loss coefficients, junction flow liquid entrainment and condensation heat transfer often are treated in different ways, resulting in significant analytical deviations. Treatment of these separate effects in the containment code CORAN is briefly discussed and demonstrated in comparison with experimental results. (13 refs.)

65627 The multi-compartment-code 'WAVCO', developed to analyse the behaviour of non-condensables during hypothetical accidents. M.Fischer, K.Hassmann (Kraftwerk Union Aktiengesellschaft, Erlangen, Germany), H.H.Reineke, B.Wohler.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1058-63 vol.2
The objective of this project is to analyse whether local burning effects can result in a dangerous high loading of the containment shell. For such detailed burning considerations, the knowledge of the state of the atmosphere and the mixing of the different constituents is needed. Therefore the code 'WAVCO' has been developed in order to provide a flexible, physical and numerical model which is able to calculate the time-dependent thermodynamic behaviour of condensables and non-condensables in a multi-compartment PWR-containment. The code was designed to calculate slow, as well as very transient processes. The first part contains a detailed description of the physical phenomena considered and the numerical method used to solve the problem-related equation system. Finally, some results of the analysis of very transient accident are presented. (3 refs.)

65628 Development of new containment pressure transient analysis computer code and its application to core degraded/melt-down accident analysis. K.Okabe, Y.Amano, T.Kohriyama, Y.Furukawa (Mitsubishi Atomic Power Industries Inc., Tokyo, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1064-74 vol.2
A new computer code called ESTEEM was developed for the estimation of a PWR dry containment pressure and temperature transient in a hypothetical accident. ESTEEM can simulate a containment as a multi-node network and it can also treat the burning of non-condensable gases. It was applied to the analyses of the two containment experiments of a large scale spray depressurization at Japan Atomic Energy Research Institute and a pressurization at subcooled water blowdown at Battelle Frankfurt Institute. ESTEEM could simulate well the thermal-hydraulic behaviors in both the experiments. Analytical results by ESTEEM about the containment pressure transient of typical 1000 MWe PWR plant at the core melt accident are also presented, and the required researches as future works related to H_2 burning are summarized. (17 refs.)

65629 Transient flow through T-junctions. K.N.Tennankore, D.R.Greig (Atomic Energy of Canada Ltd., Pinawa, Manitoba, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1075-82 vol.2
A well-mixed transient-flow model for T-junctions has been developed from first principles. Based on a critical review of available steady-flow loss correlations and experimental data obtained in a laboratory, the most consistent set of correlations has been identified and recommended for the model. A transient gas-flow test facility for obtaining model verification data has been commissioned. Preliminary pressure data suggest that quasi-steady flow prevails during a significant fraction of the blowdown time. Thus, quasi-steady models such as that proposed are likely to be adequate. (6 refs.)

65630 Formulating a post accident temperature profile inside containment for the Oyster Creek BWR—approach and key parameter identification. N.G.Trikouros (GPU Nuclear Corp., Parsippany, NJ, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1083-93 vol.2
The NRC 'Guidelines for Evaluating Environmental Qualifications of Class IE Electrical Equipment in Operating Reactors' indicates that Boiling Water Reactors are to use 340°F (171°C) for 6 hours as the basis for judging whether individual component qualifications meet the guidelines. Some BWR licensees indicated that they might want to use plant specific analyses to justify less severe environmental conditions and thus to take exception to the guidelines. In this way, the technical issue of whether or not a plant specific analysis justifies less severe conditions than 340°F (171°C) for 6 hours was raised. The author provides a description of the work which was performed in fulfilment of the task of providing a plant specific containment temperature profile for the environmental qualification of equipment at Oyster Creek. The analytical methodology which was used, the analysis approach, and the analysis results, are described. In addition, the parameters which were most significant to the containment response characterization are identified and discussed. (9 refs.)

65631 Failure modes of a concrete nuclear containment building subjected to hydrogen detonation. L.E.Fugelso, T.A.Butler (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1094-101 vol.2
The calculated response for the Indian Point reactor containment building to static internal pressure and one case of a dynamic pressure representing hydrogen combustion and detonation are presented. Comparison of the potential failure modes is made. (14 refs.)

65632 Turbulent condensation on a cold wall in the presence of a noncondensable gas. M.Corradini (Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1102-10 vol.2
A condensation model for forced and natural convection is derived by extending the Reynolds-Colburn analogy for heat and momentum transfer to mass and momentum transfer. The model is compared to the steady state data of Uchida (1965) and Tagami (1965), and found to be in reasonable agreement with the forced convection data when an imposed velocity of two meters per second is assumed. The natural convection model derived has the same functional dependence on Grashof number ($h_{TOT} \sim Gr^{-.37}$) as the data of Akers (1960). (17 refs.)

65633 Containment condensing heat transfer. R.G.Gido, A.Koestel (Energy Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1111-19 vol.2
Presents a mechanistic heat-transfer model that is valid for large-scale containment heat sinks. The model development is based on (1) the determination that the condensation is controlled by mass diffusion through the vapor-air boundary layer, and (2) the application of the classic triple analogy to formulate expressions for the transfer of heat and mass based on hydrodynamic measurements of the momentum transfer. As a result, the analysis depends on the quantification of the shear stress (momentum transfer) at the interface between the condensate film and the vapor-air boundary layer. In addition, the currently used Tagami (1965) and Uchida (1965) test observations and their range of applicability are explained. (28 refs.)

65634 Research on the behaviour of Mark II pressure suppression containment system during LOCA, carried out at the University of Pisa. M.Carcassi, M.Mazzini, P.Vigni (Dipartimento di Costruzioni Meccaniche e Nucleari, Univ. of Pisa, Pisa, Italy).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1120-7 vol.2
A wide theoretical and experimental research, about the Mark II—General Electric Pressure Suppression Containment System (PSCS), has been carried out for a long time by the 'Istituto di Impianti Nucleari' of the University of Pisa. The aim of the research has been the investigation of the behaviour of PSCS during large LOCA and particularly during blow-down. The most important experimental results (pressure oscillations in the first phase of the transient, pressure maxima at the end of blow-down) are presented. The oscillatory behaviour in the first phase of the thermalhydraulic transient involved a review of the theoretical basis of the research. So a physical-mathematical model (implemented in SOPRE SD2 code) has been set-up; in

parallel, the problem of scaling laws related to this oscillation phase has been considered. As a general conclusion, the meaning of the research is presented, in relation to the behaviour of real Mark II systems following large LOCA. (13 refs.)

65635 Pressure oscillations in vent tubes induced by steam condensation in pressure suppression containment. H.Nariai (Inst. of Engng. Mech., Univ. of Tsukuba, Ibaraki, Japan), I.Aya.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1128-34 vol.2
Pressure oscillations in vent tubes during steam condensation in pool water were investigated with a simulation experiment for a pressure suppression containment. The test rig consists of a header with 0.005 m^3 volume simulating the drywell and a vent tube with the dimensions of either 18 mm inside diameter and 0.5 m long or 18 mm inside diameter and 0.8 m long. Patterns of pressure and fluid oscillations were classified into four regimes: large chugging, small chugging, condensation oscillation, and bubbling without high frequency component in oscillation. Modellings of the oscillations were conducted considering the changes of condensation rates around steam-water interfaces. The effects of water temperatures and average steam flow rates on the high frequency and also on the low frequency components in pressure oscillations both appearing in large chugging, in small chugging, and in condensation oscillation were investigated. (5 refs.)

65636 Steam density oscillations in two phase-two component flow. F.Sakkal, E.Aust (Inst. fur Anlagentech., GKSS-Forschungszentrum Geesthacht, Geesthacht, Germany).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1135-42 vol.2
The GKSS-Forschungszentrum is currently conducting a test program on a multivent BWR-related pressure suppression system. Main subject of this experimental R+D-work is to provide definitive information about the function and the effectiveness of a pressure suppression containment under loss-of-coolant accident conditions. During the performed tests density oscillations have been observed inside the used vent pipes, caused by condensation effects, which mainly influence the two phase-two component flow through the vent pipes. The saturated steam density of this flow was determined by measuring the transmission intensity of an infrared beam. It can be stated that the used infrared measurement with respect to its sensitive principle allows a very sensible evaluation of steam density oscillations with detailed information about the nature of the analysed two phase-two component flow. (4 refs.)

65637 Evaluation of LOCA hydrodynamic loads for BWR Mark-II containments caused by steam condensation. T.Hattori, Y.Tanaka (Tokyo Electric Power Co., Tokyo, Japan), M.Arinobu, E.Shiho, H.Aoki, M.Utamura, K.Moriya, O.Oyamada.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1143-8 vol.2
In the case of a postulated loss of coolant accident for a boiling water reactor (BWR), steam is injected into water and condenses in the pressure suppression pool. The condensation phenomena cause dynamic loads on the pool boundary. The dynamic load evaluation methodology has been developed for the condensation phenomena called condensation oscillation and chugging for BWR Mark-II containments. The load evaluation methodology is based on an analytical model and on the seven vent full scale test results performed by Japan Atomic Energy Research Institute. The random nature of the phenomena has been considered in load evaluation for condensation oscillation as well as for chugging. The evaluated loads due to condensation oscillation are markedly small, compared with those due to chugging. Examples of evaluated loads due to both phenomena are shown for a typical Mark-II containment. The so-called fluid structure interaction effects on the base data have also been examined and discussed. (7 refs.)

65638 An analysis of multiple bubble behaviors in a BWR suppression pool. M.Utamura (Energy Res. Lab., Hitachi Ltd., Ibaraki, Japan).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1149-54 vol.2
Dynamics of a multiple bubble system in a BWR suppression pool have been studied considering interactions between bubbles. Based on the potential flow theory, these dynamic interactions have been expressed assuming spherical bubbles. Extension to an arbitrary pool configuration has been made by use of the boundary element method. Numerical results for air bubble oscillation have shown that the interactions cause frequency and magnitude to decrease provided the bubbles oscillate in phase. Experimental verification has also been carried out using simulated air bubbles. (4 refs.)

65639 Analysis of the Three Mile Island (TMI-2) hydrogen burn. J.O.Henrie, A.K.Postma (Rockwell Hanford Operations, Richland, WA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1157-70 vol.2
As a basis for the analysis of the hydrogen burn which occurred in the Three Mile Island Containment on March 28, 1979, a study of recorded temperatures and pressures was made. Long-term temperature information was obtained from the multipoint temperature recorder which shows 12 containment atmosphere temperatures plotted every 6 min. The containment atmosphere pressure recorder provided excellent long- and short-term pressure information. Short-term information was obtained from the multiplex record of 24 channels of data, recorded every 3 sec, and the alarm printer record which shows status change events and prints out temperatures, pressures, and the time of the events. The timing of these four data recording systems was correlated and pertinent data were tabulated, analyzed, and plotted to show average containment temperature and pressure versus time. The data used have not been qualified and accuracy is not fully assured. Photographs and videotapes of the containment entries provided qualitative burn information. Hydrogen concentrations and burn damage are discussed. (7 refs.)

65640 Detonability of containment building atmospheres during core-meltdown accidents. R.Jaung, A.L.Berlad, W.T.Pratt (Dept. of Nuclear Energy, Brookhaven Nat. Lab., Upton, NY, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1171-7 vol.2
During core-meltdown accidents in light water reactors, significant quantities of combustible gases could be released to the containment building. The highest possible peak pressure fields that may occur through combustion processes are associated with detonation phenomena. Accordingly, it is necessary to understand and identify the possible ways in which detonations may or may not occur. Although no comprehensive theory of detonation is currently available, there are useful guidelines, which can be derived from current theoretical concepts and the body of experimental data. The authors examine these guidelines and indicate how they may be used to evaluate the possible occurrence of detonation-related combustion processes. In particular, this study identifies three features that an initiation source must achieve if it is to ultimately result in a stable detonation. One of these features requires post-shock initial conditions that lead to very short ignition delays. This concept is used to examine the possibility of achieving quasisteady detonation phenomena in nuclear reactor containment buildings during postulated core-melt accidents. (23 refs.)

65641 Hydrogen combustion in aqueous foams. M.R.Baer, S.K.Griffiths, J.E.Shepherd (Sandia Nat. Labs., Albuquerque, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1178-85 vol.2
Water fogs are recognized as an effective means to mitigate the effects of large-scale hydrogen combustion that might accompany some loss-of-coolant nuclear reactor accidents. Fogs of sufficiently high density to produce large beneficial effects may, however, be difficult to generate and maintain. An alternate method of suspending the desired mass of water is via high expansion-ratio aqueous foams. Because, in practice, the foam would be generated using the combustible gaseous contents of the containment vessel, combustion occurs inside the foam cells. Although foams generated with inert gas have been well studied for use in fire fighting, little is known about combustion in foams generated with flammable mixtures. To help assess the usefulness of aqueous foams in a mitigation plan, the authors have conducted several open tube tests and over one hundred closed vessel tests of hydrogen/air combustion with and without foam. (20 refs.)

65642 Hydrogen generation during molten-fuel-coolant mixing. M.Corradini (Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1186-94 vol.2
In the absence of adequate cooling water to the core of a light water reactor the fuel and cladding may melt. This molten material may mix with remaining water in the lower plenum or in the reactor cavity and generate hydrogen. A simple fuel-coolant mixing model is developed here to predict the minimum fuel diameter that can be attained during mixing. This result is used with other analyses to predict the rate of hydrogen generation when the fuel is molten. (23 refs.)

65643 Development and applications of a computer program for modelling the response to hydrogen burns in containment. M.J.Wester, S.E.Dingman, A.L.Camp, M.P.Sherman, P.G.Prassinos (Sandia Nat. Labs., Albuquerque, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1195-202 vol.2
Sandia National Laboratories is engaged in an NRC-sponsored program to study the problems associated with hydrogen generation in light water reactors. As part of that effort, the authors have developed a computer program called HECTR (hydrogen event: containment transient response), which models hydrogen burns in containments and the associated important heat transfer mechanisms. They summarize the capabilities of HECTR and present some calculational results. HECTR has been used to evaluate some hypothetical accidents for the Grand Gulf Mark III BWR. A number of cases were run with various compartment arrangements, burn times, etc. Other cases were run for comparison against the MARCH and CLASIX-3 codes. Qualitatively similar results were produced in most cases. Quantitative differences, in most cases, appear to be due to differences in the input assumptions and the heat transfer and burn models. (10 refs.)

65644 Combustion of hydrogen at high concentrations including the effect of obstacles. R.K.Kumar, H.Tamm, W.C.Harrison, G.Skeet, J.Swiddle (Whiteshell Nuclear Res. Establ., Atomic Energy of Canada Ltd., Pinawa, Manitoba, Canada).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1203-11 vol.2
Combustion of hydrogen-steam-air mixtures has been studied in a 2.3-m diameter sphere at 100°C and near atmospheric pressure. The range of concentrations investigated were 10% to 42% hydrogen and 0% to 30% steam by volume. Over this range, the combustion proceeded until one of the reactants was completely consumed. Measured peak combustion pressures were 10 to 20% below the calculated, adiabatic values. The effect of fan generated turbulence was less pronounced at high hydrogen concentrations than at low concentrations. The effect of obstacles was investigated by placing gratings in the sphere. Although gratings increased the extent of combustion and the peak pressure at low concentrations, their effect was less at high hydrogen concentrations. In general, gratings acted as heat sinks, reducing, in some cases, the peak pressure as well as the rate of pressure rise. These observations are preliminary and further studies are required for confirmation. (8 refs.)

65645 Hydrogen combustion results from the Sandia intermediate-scale (VGES) tank and the Sandia critical-tube-diameter test facility. J.C.Cummings, W.B.Benedick, P.G.Prassinos (Reactor Safety Studies Div., Sandia Nat. Labs., Albuquerque, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1212-18 vol.2
Sandia National Laboratories is currently involved in several experimental projects to provide data that will help quantify the threat of hydrogen combustion during LWR accidents. One project, which employs several experimental facilities, is the Variable Geometry Experimental System (VGES). The authors present descriptions of and experimental results from two of these facilities: an intermediate-scale burn tank (~5 m^3) and a critical-tube-diameter test facility. (5 refs.)

65646 A simplified hydrodynamic model of hydrogen flame propagation in reactor vessels. M.R.Baer, A.C.Ratzel (Sandia Nat. Labs., Albuquerque, NM, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1219-28 vol.2
A hydrodynamic model for hydrogen flame propagation in reactor geometries is presented. This model is consistent with the theory of slow combustion in which the gasdynamic field equations are treated in the limit of small Mach numbers. To the lowest order, pressure is spatially uniform. The flame is treated as a density and entropy discontinuity which propagates at prescribed burning velocities, corresponding to laminar or turbulent flames. Radiation cooling of the burned combustion gases and possible preheating of the unburned gases during propagation of the flame is included using a molecular gas-band thermal radiation model. (15 refs.)

65647 Design basis leak analyses for designing the sodium-water reaction products subsystem for the large developmental plant. N.Vasudevan, B.E.Bingham (Nuclear Power Generation Div., Babcock & Wilcox Co., Lynchburg, VA, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1231-6 vol.2

The sodium-water reaction products subsystem for an LMFBR is designed based on a spectrum of leaks that will cause sodium-water reaction in the steam generators. The authors describe the approach taken to design this subsystem for the Large Developmental Plant under contract to the US Department of Energy. Conclusions emphasize the need to perform parametric analyses to determine the worst leak location in the steam generator for the subsystem design. The use of design basis leaks to design the system is outlined, and the optimization of certain system parameters is discussed. (14 refs.)

65648 Thermalhydraulic characteristics in LMFBR hot plenum. N.Tanaka, S.Moriya, A.Wada (Central Res. Inst. of Electric Power Industry, Chiba, Japan).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1237-47 vol.2

The most important problem in the thermalhydraulic designs of the pool-type FBR is to estimate the thermal conditions affecting the vessel and/or internal structures during both steady and transient operations. The severity of these conditions in the Japanese pool-type reactor which will be reinforced and equipped with special devices for aseismic demands are apt to be much greater than other countries. Water tests and thermalhydraulic analyses have been performed to study such conditions. The main purpose of this study is to estimate the effects of the elevations of UIS (Upper Internal Structure) discharge and IHX (Intermediate Heat Exchanger) intakes of flow patterns, free surface disturbance and thermal-stratification in hot plenum. From the results of the experiments, suitable elevations could be recommended by comparing some thermalhydraulic characteristics. The calculations agreed well with the experimental results on the steady-state flow patterns and thermal-transients except the thermal-stratification. (8 refs.)

65649 Film boiling characteristics of liquid metals in the Leidenfrost phenomenon. K.Miyazaki, Y.Harada, N.Yamaoka, S.Inoue (Dept. of Nuclear Engng., Osaka Univ., Osaka, Japan), Y.Fujii-e.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1254-61 vol.2

In a steel container filled with 1.0 bar argon gas, potassium or sodium droplets were put on a heated plate and observed by a camera and a VTR through viewports. In the case of potassium, plates of 316-stainless steel and tantalum were used respectively for low and high temperatures and joule-heated by a DC power supply, while in the case of sodium, a tantalum disk was induction-heated by a 20 kHz and 30 kW power supply. Stable film boiling was observed for a high temperature of the plate or disk, whereas an instantaneous breakup of the droplet with extensive vaporization occurred for a low temperature. Whether or not a droplet did float on the plate was mainly governed by the interface temperature at the contact. The heat flux was estimated from the volumetric reducing rate of the droplet observed. For potassium, the results in the film boiling region showed an appreciably good agreement with prediction based on the Bromley's expression (1950) combined with the theory of Baumeister et al. (1966). For sodium, the experimental results were slightly higher than the prediction. (13 refs.)

65650 On the growth of large spherical sodium vapor bubbles in a liquid sodium pool. F.Casadei, M.D.Donne (Kernforschungszentrum Karlsruhe, Karlsruhe, Germany).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1262-73 vol.2

The study of the dynamics of the expansion of large bubbles of hot sodium vapor in a pool of liquid sodium plays an important role in understanding the effects of a HCDA. A model of the growth of the bubble in the pool is described. The equation of the motion of the liquid and the nonsteady heat diffusion problem are solved together with the continuity and energy equations for the vapor phase. The first set of calculations have been performed with constant evaporation and condensation coefficients. In the second, however, due account has been taken of the effect on the condensation of noncondensable fission gases and vapor convection. Due to the very high calculated vapor velocities, noncondensable gases have little effect on the condensation rate and the percentage amount of condensed sodium is considerably higher than previously calculated by other authors. (18 refs.)

65651 Synthesis of clad motion experiments interpretation: codes and validation. J.Papin, M.Fortunato (Centre d'Etudes Nucleaires de Cadarache, Saint Paul Lez Durance, France), J.-M.Seiler.

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1274-81 vol.2

Deals with clad melting and relocation phenomena related to LMFBR safety analysis of loss of flow accidents. The authors present the physical models developed at DSN/CEN Cadarache in single channel and bundle geometry, and the interpretation, with these models of experiments performed by the STT (CEN, Grenoble). It comes out that they have now obtained a good understanding of the involved phenomena in single channel geometry. On the other hand, further studies are necessary for a better knowledge of clad motion phenomena in bundle cases with conditions close to reactor ones. (5 refs.)

65652 Two-phase, two-component thermohydraulic conditions produced in the vent line of a steam generator following a sodium-water reaction. D.A.Greene (Advanced Reactor Systems Dept., General Electric Co., Sunnyvale, CA, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1282-92 vol.2

Presents techniques for calculating the thermohydraulic conditions in the vent line of a steam generator following a sodium-water reaction. The reaction produces copious quantities of hydrogen gas. This gas is vented into a collection tank through a duct. Depending upon the elapsed time from initiation of the reaction, the duct is filled with liquid sodium or liquid-sodium and hydrogen gas mixture. Equations were derived from first principles to describe the pressure gradients in the duct for a mixture of incompressible liquid and ideal gas under choked flow conditions. These equations were solved for liquid sodium and hydrogen gas using a computer. Solutions were obtained covering a broad range of parameter values and plotted to provide engineering design charts. These charts allow for a simple step-by-step calculation of the pressure gradients along the duct and the resulting pressures inside the steam generator. Several examples are developed to demonstrate methods of using the charts. Other design parameters, such as thrust from the fluid and vent line temperatures, are also calculated to complete the analysis of the venting system. (6 refs.)

65653 Thermal striping in liquid metal cooled fast breeder reactors. C.Betts, C.Boorman, N.Sheriff (Risley Nuclear Power Dev. Labs., UKAEA, Warrington, England).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1292-301 vol.2

Thermal striping is the random thermal cycling of a component by a flow stream resulting from the mixing of flow streams at different temperatures. In a liquid metal cooled fast breeder reactor it occurs in the above core plenum as a result of the mixing of coolant jets from core and breeder sub-assemblies. It is necessary to consider the temperature cycling in the context of fatigue of the striped component. The results of applying standard techniques are discussed and lead to the peak-to-peak temperature difference of the fluctuation as being important. The use of simulant fluids to examine the thermal-hydraulics of thermal striping is discussed and two models using air are described. Some characteristics of the peak-to-peak temperature variations obtained on these models are presented and compared with data obtained in sodium in PFR. (8 refs.)

65654 Boiling and dryout conditions in disturbed cluster geometry and their application to the LMFBR local fault assessment. K.Yamaguchi, H.Nakamura, K.Haga (O-arai Engng. Center, Power Reactor & Nuclear Fuel Dev. Corp., Ibaraki-ken, Japan).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1310-17 vol.2

The effect of a local cooling disturbance caused by an edge-type blockage in an LMFBR fuel subassembly was investigated with a series of out-of-pile local blockage experiments with water and sodium. The heat exchange layer model first developed for central-type blockage cases applied well to the present edge-type ones. An empirical formula was developed for estimating maximum temperatures in various subassemblies, and the conclusion was reached that a middle size edge-type blockage could lead to sodium boiling. The critical heat flux data of PNC and KfK were correlated with the boiling inception heat flux for various core flow velocities. A linear relation was found between them, suggesting a possible interpretation of the coolability limit within the frame of non-boiling conditions. The theoretical (hypothetical) excess temperature in the absence of boiling, ΔT_{ms} ($=T_{max}-T_{sat}$), seemed to cross a critical value at the instance of permanent dryout. Based on the constant critical ΔT_{ms} assumption and the formula for T_{max}, an assessment was made of the thermohydraulic consequences for the different blockage size situations of a typical LMFBR. (13 refs.)

65655 Fuel penetration of intersubassembly gaps in LMFBRs (a calculational method with the SIMMER-II code). G.P.DeVault (Los Alamos Nat. Lab., Los Alamos, NM, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1338-54 vol.2

Early fuel removal from the active core of a liquid-metal-cooled fast breeder reactor (LMFBR) undergoing a core-disruptive accident may reduce the potential for large energetics resulting from recriticalities. A possible avenue for early fuel removal in heterogeneous core LMFBRs is the failure of duct walls in disrupted driver subassemblies followed by fuel penetration into the gaps between blanket subassemblies. The SIMMER-II code was modified to simulate flow between subassembly gaps. Calculations with the modified SIMMER-II code indicate the capabilities of the method and the potential for fuel mass reduction in the active core. (3 refs.)

65656 Two-dimensional steady-state thermal and hydraulic analysis code for prediction of detailed temperature fields around distorted fuel pins in an LMFBR assembly: SPOTBOW. T.Shimizu (Nuclear Res. Lab., Nippon Atomic Industry Group Co. Ltd., Kanagawa-Ken, Japan).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1355-64 vol.2

The SPOTBOW computer program has been developed for predicting detailed temperature and turbulent flow velocity fields around distorted fuel pins in LMFBR fuel assemblies, in which pin-to-pin and pin-to-wrapper tube contacts may occur. The present study started from the requirement of reactor core designers to evaluate local hot spot temperatures due to the wire contact effect and the pin bowing effect on cladding temperature distribution. This code calculates for both unbaffled and wire-wrapped pin bundles. The Galerkin method and iterative procedure were used to solve the basic equations which govern the local heat and momentum transfer in turbulent fluid flow around the distorted pins. Comparisons have been made with cladding temperatures measured in normal and distorted pin bundle mockups to check the validity of this code. (12 refs.)

65657 Investigation of flow recirculation in a rod bundle during natural-convection flow and power transients. J.A.Fort, J.M.Bates, D.R.Rector, E.U.Khan (Pacific Northwest Lab., Richland, WA, USA).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1365-81 vol.2

An experimental investigation conducted at the Pacific Northwest Laboratory studied the flow recirculation phenomenon in a rod bundle during natural-convection flow and power transients. The experimental data were used to validate the recirculation model in the COBRA-WC computer program. The COBRA-WC code was then used to predict the flow and temperature fields in a prototypic Liquid Metal Fast Breeder Reactor (LMFBR) blanket assembly for a worst-case, natural-convection transient. (7 refs.)

65658 Heat transfer by natural convection in sodium from downward facing surfaces. D.Tenchine, M.Amblard (Service des Transferts Thermiques, CENG, Grenoble, France).

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1412-17 vol.2

The safety analysis of pool type LMFBR might have to consider an eventual deposition of molten fuel on a core catcher plate. The present work deals with the heat exchange by natural convection in sodium from the downward facing surface of the core catcher plate. Analytical considerations are developed to determine the governing parameters and to define a realistic water model based on similarity criteria. It is shown that a liquid metal experiment with simplified boundary conditions is necessary to evaluate the uncertainty on the transposition from water mode data to the reactor. Main results from the water model and the sodium experiment are presented and compared with previous analytical and experimental data. An extrapolation from these results to the reactor case is proposed with an evaluation of the mean heat transfer correlation from the downward facing surface of the core catcher plate. (8 refs.)

65659 **BLOWAES: a method for evaluating blowdown two phase flowrate from pressure and thrust measurements.** F.D'Auria, P.Vigni (Dipartimento di Costruzioni Meccaniche e Nucleari, Univ. of Pisa, Pisa, Italy).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1469-76 vol.2
This work concerns the evaluation of various flow parameters during two-phase critical blowdown from a pressure vessel subsequently to a pipeline break. In particular BLOWAES (BLOWdown Analysis from Experimental Signals) allows one to obtain, from pressures and jet thrust measurements, the main blowdown related quantities like void fraction, quality and mixture velocity inside the pressure vessel and in the exit pipe. After a brief outline of difficulties currently encountered in two-phase critical flowrate evaluation, the basic program equations and the results of four applications are presented and discussed. (12 refs.)

65660 **Effects of cladding external thermocouples and electrical heater rod design on quench behavior.** R.C.Gottula, E.L.Tolman (EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1491-9 vol.2
Separate effects experiments were conducted on a bundle of nine electrical heater rods in the Loss-of-Fluid Test Support Facility at the Idaho National Engineering Laboratory. The objectives of these experiments were to evaluate the effect of cladding external thermocouples on the quench (cooling) behavior of a cartridge-type nuclear fuel rod simulator, to determine how accurately cladding external thermocouples measure cladding temperature during a high-pressure quench, and to compare the quench behavior of a cartridge-type heater rod (which simulates a fuel-pellet-cladding gap) with that of a solid-type heater rod (without a fuel-pellet-cladding gap) under thermal-hydraulic conditions that could occur during the blowdown phase (0 to 10 s) of a large break loss-of-coolant accident in a pressurized water reactor. (8 refs.)

65661 **Investigation of the effects of heater characteristics on post-CHF performance of a long vertical annulus in high pressure water.** A.Leung (Atomic Energy of Canada Ltd., Mississauga, Ontario, Canada), S.Banerjee, D.C.Groeneveld.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1500-5 vol.2
Post-CHF tests were performed in water on two identical annuli with 4.88 m heated length. The inner rod in one annulus was heated directly; the other was heated indirectly. The experiments were conducted at 9.7 MPa exit pressure over mass fluxes ranging from 2 to 5 $Mg.s^{-1}.m^{-2}$ and inlet qualities from −10 to −40%. The objective was to determine the effect of the type of heating on post-CHF heat transfer. The experimental results show that the maximum wall temperatures of the heaters were similar except at the highest mass flux tested at which the wall temperatures for the indirect heater were found to be lower. Also, circumferential spreading of the dry patch appeared to occur more readily for the indirect heater than for the direct heater, although the experimental evidence is by no means conclusive on this point. Finally, the spacers used to position the heater appeared to limit axial spreading of the dry patch. Qualitative explanations for these phenomena are discussed. (6 refs.)

65662 **Primary pump power as a measure of fluid density during bubbly two-phase flow.** G.E.McCreery, J.H.Linebargeer, J.E.Koske (EG&G Idaho Inc., Idaho Falls, ID, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.1519-25 vol.2
A nuclear plant operator requires other information on reactor coolant system inventory besides just pressurize liquid level, which often disappears or gives ambiguous indications during a loss-of-coolant accident. Erroneous instrument readings during the Three Mile Island and Ginna accidents are examples. Pump power or current is shown to provide an additional source of inventory information. When the reactor coolant pumps are operating, it allows the operator to make decisions about the advisability of continued pump- and safety-injection operation. The inventory information is provided by a simple method of calculating fluid density for bubbly two-phase flow by relating pump power or current to fluid density. The calculational method is derived and compared with data. Calculations using the method agree well with the measured experimental data with increasing void fraction, until the flow transitions from bubbly to partially stratified churn flow within the pump. (11 refs.)

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems .... See Entry 64588

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A review of current heat transfer correlations used in reactor safety assessment .... See Entry 65497

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28.50 FISSION REACTOR TYPES AND APPLICATIONS

65663 **Further developments of high-temperature reactors in Japan, in the USSR and in other countries.** E.Balthesen (Bundesministeriums fur Forschung und Technol., Bonn, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.62, no.12, p.1015-17 (Dec. 1982). In German.
The paper conducts a survey of the programme advanced partly independently and partly by the International Atomic Energy Agency in the 'Gas-Cooled Reactors' Working Group for the construction of high-temperature reactors in various countries. In this area international collaboration appears to be desirable for further development. At the present time no risk is seen that HTR technology is being developed only in the Federal Republic of Germany. (no refs.)

65664 **Electricity and process steam from a 500 MW high-temperature reactor.** E.Baust (Hochtemperatur-Reaktorbau GmbH, Mannheim, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.62, no.12, p.1018-24 (Dec. 1982). In German.
Today all gas-cooled reactors together have operating periods which can be validly compared with those of pressurized and boiling water reactors. This positive balance and the recently observed trend towards smaller output capacities of 300 to 600 MW electrical output make the high-temperature reactor eminently suitable to meet this by virtue of its favourable technical and engineering safety characteristics. In this respect the Thorium High-Temperature Reactor (THTR) 300 will play an important part as a prototype and reference plant. (3 refs.)

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems .... See Entry 64588

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The market potential of the high-temperature reactor .... See Entry 68858

28.52 FUSION REACTORS

(for confinement, see 52.55)

65665 Fusion reactor plasmas with polarized nuclei. R.M.Kulsrud, H.P.Furth, E.J.Valeo (Princeton Plasma Phys. Lab., Princeton, NJ, USA).
AIP Conf. Proc. (USA), no.95, p.637 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Summary form only given. Nuclear fusion rates can be enhanced or suppressed by polarization of the reacting nuclei. In a magnetic fusion reactor, the depolarized time is estimated to be longer than the reaction time. (no refs.)

65666 Irradiation creep in the fusion reactor first wall. W.A.Coghlan, L.K.Mansur (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Res Mech. (GB), vol.7, no.2, p.85-124 (1983).
Reviews experimental data and theoretical developments in the area of irradiation creep, with special emphasis on those aspects relevant to fusion reactor systems. The authors identify five irradiation conditions which are present in most fusion designs but are different from the conditions found in fission reactors: (1) large number of defects produced per primary knock-on atom (PKA), (2) high helium production rate, (3) cyclic operation, (4) unique stress histories, and (5) low-temperature operation. Theoretical considerations are used to deduce additional characteristics of irradiation creep in the fusion reactor for which no experimental data are available. (68 refs.)

65667 Ablative acceleration of pellet shells irradiated by external soft X-ray sources. T.Mochizuki, S.Sakabe, K.Okada, H.Shiraga, T.Yabe, C.Yamanaka (Inst. of Laser Engng., Osaka Univ., Suita, Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L133-5 (March 1983).
The first direct experimental measurement of soft X-ray driven ablation pressure has been done using a spherical pellet target and external soft X-ray sources. It has been found that the pressure is about 10 Mbar at an incident X-ray intensity I_x of 10^{13} W/cm^2 for glass and CH targets, and its intensity scaling is $I_x^{0.8}$. X-ray backlighted pellet images indicate that X-ray geometri-

cal smoothing at indirect irradiation is very effective for symmetrizing the implosion. (13 refs.)

65668 Dynamic HVEM observations of metals and alloys during in-situ helium ion irradiations. W.A.Jesser (Dept. of Materials Sci., Univ. of Virginia, Charlottesville, VA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1259-62 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A 200 kV ion accelerator, with a PIG source for accelerating ionized gases, was coupled to a 500 kV transmission electron microscope in order to investigate the effects of helium irradiation on the development of microstructure in candidate fusion reactor first wall material. The microstructural evolution in nickel and in type 316 stainless steel bombarded by 80 keV helium ions was monitored via video recordings. The effect of specimen thickness and temperature and the effect of plastic deformation during irradiation was considered. (22 refs.)

65669 Oxidation of tritium gas in glovebox atmosphere using CuO column. M.Nishikawa, T.Isayama, K.Shinnai (Dept. of Nuclear Engng., Kyushu Univ., Fukuoka, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.145-53 (Feb. 1983).
A multiple barrier containment concept for tritium control is proposed to provide minimal release to the environment. The rationale for this design is the prevention of the dilution of tritium within each barrier so that the tritium can be recovered before it penetrates to the outer barrier. The oxidation performances of a CuO sponge column in the inert atmosphere of a glovebox system are considered. The oxidation column efficiency is found to play an important role in the tritium level decrease on the glovebox atmosphere. (20 refs.)

65670 Neutronics design of tritium breeding blanket for fusion experimental reactor. S.Mori (Nuclear Systems Div., Kawasaki Heavy Industries Ltd., Tokyo, Japan), Y.Seki, H.Kawasaki.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.154-62 (Feb. 1983).
Detailed neutronics analysis of a Tokamak fusion experimental reactor was performed. The neutronics responses of components in the vacuum vessel of a swimming pool type reactor were calculated by Monte Carlo methods considering toroidal geometry, asymmetrical torus cross section, and neutron source distribution in plasma. It was found that the neutronics responses in the first wall and the blanket vary significantly in the poloidal direction. The effect of penetrations of neutral beam injectors on the tritium breeding performance was also evaluated in the analysis. The result shows that the effect is rather small in the present structure and it becomes clear that modifications of the blanket structure and material composition are needed to improve the tritium breeding performance and reduce the nuclear heating rate of the vacuum vessel in the divertor zone. (12 refs.)

65671 Surface irradiation damage of 316 stainless steel, vanadium and molybdenum by helium ion bombardment. H.Shinno, H.Shiraishi, T.Kimoto (Tsukuba Labs., Nat. Res. Inst. for Metals, Ibaraki, Japan), R.Watanabe.
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.163-73 (Feb. 1983).
Molybdenum, V and 316 stainless steel were irradiated with 50~150 keV He ions at temperatures between 413 and 1298K for total doses ranging $1\times10^{22}\sim1\times10^{23}$ m^{-2}, and the characteristics of the surface damage were compared. Severe exfoliation was observed in all of these materials; the number of exfoliated skins was larger than that in literature, and increased nearly in proportion with the total dose. When the dose was low, the amount of erosion increased rapidly with total dose, but tended to be saturated for doses higher than 3×10^{22} m^{-2}. At temperatures over 923K, blisters and a porous surface were formed and the exfoliation of skins ceased. (24 refs.)

65672 Effect of particle recycling on burn control by compression-decompression. M.Ohnishi, A.Saiki, M.Okamoto (Inst. of Atomic Energy, Kyoto Univ., Kyoto, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.177-9 (Feb. 1983).
The authors study the effect of a finite particle confinement time on burn control by major radius compression-decompression, without the conservation of total fuel ions. The feedback control of fuel density in addition to the compression-decompression control to suppress thermal instability is also investigated. (5 refs.)

65673 Influence of preliminary neutron irradiation upon helium blistering in OKh16N15M3B steel. I.I.Chernov, B.A.Kalin, D.M.Skorov, G.N.Shishkin, M.V.Ivanov.
Sov. At. Energy (USA), vol.53, no.2, p.533-6 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.80-3 (Aug. 1982). [received: April 1983]
Experimental research on radiation-induced erosion of materials under bombardment has shown that the form of the surface destruction depends significantly upon the mobility of the induced gas atoms and vacancies and on the growth mechanism of gas bubbles. The first wall in a thermonuclear reactor is subjected to irradiation by neutrons, helium ions, and hydrogen isotopes. Previous investigations have shown that surface erosion in the first stage of reactor operation results mainly from helium blistering. Some researchers believe that in prolonged reactor operation, blister formation will be suppressed either by sputtering of the surface layer of the material before the critical dose of blister formation has been reached or by nonmonochromatic compositions of the ion beams. Yet, so far, the simultaneous influence of the various ions and the neutrons upon radiation-induced erosion has not been clarified. Experiments with successive and simultaneous irradiation by helium ions and hydrogen isotopes indicate that the simultaneous implantation of D^+ and He^+ ions reduces the critical dose and enhances surface erosion vis-a-vis irradiation by ions of a single type (D^+ or He^+). (16 refs.)

65674 Multigroup system of constants for calculating high-energy neutron transport. M.Yu.Vyrskii, A.A.Dubinin, A.I.Ilyushkin, V.E.Kolesov, A.S.Krivtsov, I.I.Longe, V.P.Mashkovich, V.K.Sakharov.
Sov. At. Energy (USA), vol.53, no.2, p.572-4 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.113-14 (Aug. 1982). [received: April 1983]
In order to calculate neutron transport in reactors and shielding, the system of constants in ARAMAKO-2F OBRAZ, ARAMAK-F and others, based mainly on the collection of group constants in BNAB-26 or on the later versions BNAB-70 and BNAB-78 are widely used. These systems satisfy the basic requirements of the constants necessary for designing the reactor and shielding. However, the insufficiently detailed resolution in the fast neutron energy range, use of the fission spectrum in obtaining the group cross sections, and absence of data on a number of processes that are important at neutron energies exceeding 10 MeV make it difficult to use the systems of constants indicated above for solving problems with high-energy neutron sources. The authors attempt to create a system of group constants for the fast-neutron energy range (E>0.8 MeV) with a sufficient number of groups. The criterion of sufficiency was the independence (with an error not exceeding 3%) of the group values of the total cross sections for interaction of neutrons from the shape of the intragroup spectrum. (12 refs.)

65675 Scaling of critical beta in a Tokamak. T.Tuda, M.Azumi, G.Kurita, T.Takizuka, T.Takeda.
Report JAERI-M-82-104, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Aug. 1982), 8 pp.
The stability of Tokamaks for high-n ballooning mode is studied. The combination of a 2-D transport code and an infinite-n ballooning code is used to optimize the beta value (the ratio of the plasma pressure to the magnetic pressure). (2 refs.)

65676 Computer-aided simulation model for hydrogen isotope separating column by cryogenic distillation. M.Kinoshita.
Report JAERI-M-82-108, Japan Atomic Energy Res. Inst., Tokai, Ibaraki, Japan (Aug. 1982), 45 pp.
This paper complements and extends the previously reported works by the same author on the mathematical simulation model for hydrogen isotope separating column by cryogenic distillation. The convergence features of the proposed mathematical simulation procedure are investigated in detail and several significant estimation methods for intitial values of a set of temperatures and phase flows are developed to ensure high efficiency of the iterative calculation as well as the achievement of convergence. Discussions are made on the effects of decay heat of tritium and nonideality of the hydrogen isotope solutions on steady state column performance. (16 refs.)

65677 Thermal instability analysis in a D-T tokamak reactor with density dynamics. A.Hatayama, M.Sugihara, T.Hirayama.
Report JAERI-M-82-147, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Nov. 1982), 28 pp.
Basic models and formulations, which take account of the effects of the density dynamics (e.g. density perturbation, particle recycling, convective energy loss, etc.) are developed for the thermal instability analysis in a D-T Tokamak reactor. The one-dimensional transport equations of ion density, electron and ion temperatures are linearized with respect to the perturbations and an eigenvalue analysis is used to calculate the growth rate of the instability. Critical curve of the stable and unstable regions on the density-temperature plane is determined for the case of the INTOR scaling law. It is also shown that the density mode of the trapped-ion scaling case is completely stabilized by the effect of particle recycling. They are reexamined by the time dependent transport code. These results show that the formulations developed are well effective to investigate the effects of the density dynamics on the thermal instability. (29 refs.)

65678 Surface materials considerations for fusion reactors. K.Sone, M.Maeno, S.Yamamoto, H.Ohtsuka, T.Abe.
Report JAERI-M-82-156, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Nov. 1982), 20 pp.
Surface materials considerations have been made to support the impurity control and first wall engineering task in the INTOR. They focus on low-Z material candidates including C (graphite), SiC and TiC. (38 refs.)

65679 Graphical representation of transmutation and decay chain data, transmutation cross section and delayed gamma ray emission data.
Report JAERI-1280, Japan Atomic Energy Res. Inst., Tokai, Ibaraki, Japan (Sept. 1982), 255 pp.
In a D-T burning fusion reactor, the neutron induced activity severely limits personnel access to the reactor. Accurate evaluation of the induced activity and dose rate is necessary to conduct effective biological shield design. In order to evaluate the dose rate accurately, considerable amount of activation data is required. This report gives a graphical representation of transmutation and decay chain data, transmutation cross section data and delayed gamma ray emission data for 116 nuclides of interest in terms of fusion reactor design. This graphical representation was made with hope of producing a reference for examining activation problems. It has already been shown to be effective in correcting inappropriate data. A computer code AMOEBA developed for the checking and plotting of the activation data is also described in this report. (24 refs.)

65680 Data on trapping and re-emission of energetic hydrogen isotopes and helium in materials. S.Yamaguchi, K.Ozawa, Y.Nakai, Y.Sugizaki.
Report JAERI-M-82-118, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Aug. 1982), 77 pp.
This report presents a compilation of the experimental data on trapping and re-emission of energetic hydrogen isotopes and helium in materials. A survey has been made of the literatures up to end of 1980, by dividing it into the following seven sections: (1) dose dependence, (2) target material dependence, (3) time dependence, (4) target temperature dependence, (5) incident energy dependence, (6) damage effects, (7) ion-induced release. The experimental data for helium, however, is cited only in limited cases, because of the lack of experiments. (76 refs.)

65681 Series lecture on advanced fusion reactors. J.M.Dawson.
Report IPPJ-623, Nagoya Univ., Japan (Jan. 1983), 69 pp.
The author presents a series of lectures on the concepts involved in advanced fusion reactors. (4 refs.)

65682 Particle simulation for magnetic fusion energy devices. V.K.Decyk (Center for Plasma Phys. & Fusion Engng., Univ. of California, Los Angeles, CA, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.89-91 vol.4
The importance and utility of particle simulation in modeling of magnetic fusion devices is illustrated by an example from RF plasma heating. Computer experiments are performed which examine the assumptions made by ray-tracing and transport codes. Wave propagation near the lower hybrid resonance was found to be in substantial disagreement with prevailing views. Among proposed damping mechanisms, absorption at moderate amplitudes was found to be a stochastic process, although gradient effects may be more important than previously considered. (14 refs.)

Evaluation of neutron cross sections for vanadium .... See Entry 65268

Reactor engineering divison annual report. (April 1, 1981 - March 31, 1982) .... See Entry 65691

Spin-polarized hydrogen: new possibilities for polarized sources and targets .... See Entry 65760

A scaling law for the anomalous electron transport in Tokamaks .... See Entry 66680

Spatial diffusion of charged high-energy fusion products by shear Alfven perturbations .... See Entry 66683

Fast-ion behaviour for quasi-perpendicular high-energy neutral injection into the TFR 600 Tokamak .... See Entry 66714

Neoclassical theory of alpha-particle transport in the central region of a Tokamak plasma .... See Entry 66731

Parametric systems analysis of the modular stellarator reactor .... See Entry 66734

The confinement of alpha particles in a slightly asymmetric Tokamak reactor ....See Entry 66736

Attainment of reactor level volume-averaged toroidal beta in Doublet III ....See Entry 66737

In situ studies of the effects of ion beams on materials using the electron microscope ion beam interface .... See Entry 67055

Estimation of stacking-fault energy of Frank loops in OKh16N15M3B austenitic stainless steel .... See Entry 67067

28.80 RADIATION TECHNOLOGY, INCLUDING SHIELDING

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

65683 Liquid ionization chamber for absorbed dose determinations in photon and electron beams. K.-A.Johansson, H.Svensson (Dept. of Radiation Phys., Univ. of Gothenburg, Gothenburg, Sweden).
Acta Radiol. Oncol. Radiat. Therapy Phys. & Biol. (Sweden), vol.21, no.5, p.359-67 (1982).
The use of a liquid ionization chamber for measurements in electron and photon beams with energies above 1 MeV has been investigated. The liquid in the chamber is 2,2,4-trimethylpentane. Fundamental properties such as the reproducibility of the measured charge per absorbed dose, the temperature dependence, and the angular dependence have been experimentally analysed. The general recombination losses in pulsed beams are shown to be dependent on the transport time of the ions in the liquid. For a longer transport time than the time between two consecutive pulses the losses depend on the mean dose rate and for a shorter transport time the losses depend on the absorbed dose per pulse. The Jaffe method is used for determination of the initial recombination losses, and compared with results from other authors. (12 refs.)

65684 Radiological safety of accelerators. A comparison of performance standards. J.A.Devanney (Office of Radiological Health, Food & Drug Administration, Rockville, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1583-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The recommendation/requirements of the Suggested State Regulations are not out of line with those of the NCRP, IEC, or the proposed Canadian regulation. The 1982 Edition of the Suggested State Regulations, which reflect the philosophy of the NCRP, has the most stringent requirements for leakage radiation, both to the patient area and outside the patient area. The Canadian standard has the most stringent requirements for leakage radiation through the beam limiting devices. The IEC voluntary standard is less stringent than both the 1982 Edition of the Suggested State Regulations and the proposed Canadian regulation but is more stringent than the NCRP for leakage through the beam limiting devices. The NCRP has the least stringent requirement for leakage radiation through beam limiting devices, and at the present time does not address neutron leakage for accelerators. (11 refs.)

65685 Some specialized radiological safety considerations at Argonne National Laboratory's Heavy Ion Research Facility (SAR, shielding design, QFs, HIRC). R.H.Cooke, R.A.Wynveen (Occupational Health & Safety Div., Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1588-91 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
An existing accelerator system at Argonne National Laboratory (ANL) has been upgraded and is being extended to provide heavy ions with energies well above the nuclear binding energies (5-25 MeV/A). The final configuration of the system, called the Argonne Tandem-LINAC Accelerator System (ATLAS), is to become a user-oriented national facility for nuclear physics research. ATLAS will produce some specialized radiological safety considerations unique to this facility in addition to the safety considerations normally addressed at accelerators. (4 refs.)

65686 Radiation protection considerations of ion implantation systems. C.J.Maletskos, P.R.Hanley (VARIAN/Extrion Div., Gloucester, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1592-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Ion implanters produce beams of positive ions that impinge on target materials located in an enclosed vacuum system and are not intended to produce external beams or any other external ionizing radiation. The deceleration of positive ions produces negligible bremsstrahlung external to the implanters. The deceleration of electrons when striking beam-tube components produces bremsstrahlung resulting in significant quantities of unintended external radiation. These electrons are created by the interaction of positive ions with component parts of the implanter and with the residual gas and are subsequently accelerated in the implanter beam tube. At implanter ion energies ($<$500 keV), the bremsstrahlung is emitted in lobes essentially perpendicular to the electron stream (180° from the ion beam) modified by self-shielding from implanter structures. Experimentally, the radiation exposure rate is generally proportional to the electron current and to the square of the electron energy in essential agreement with theory. Implanter X-ray spectra are also in general agreement with spectra taken under laboratory conditions. Principles for reducing external radiation include the judicious combination of implanter design, materials with low atomic number for electrons to strike, cleanliness in assembly, use of suppression fields to reduce the number of electrons, shielding, interlocks, and operation. (5 refs.)

65687 Radiation safety systems at Brookhaven National Laboratory's low-energy accelerators. C.W.Flood,Jr. (Safety & Environmental Protection Div., Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1597-600 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Brookhaven National Laboratory has several low-energy accelerators in use at the present time. The author discusses the radiation safety systems installed at five of these accelerators. The accelerators included are a Dynamitron, 3.5 MeV Van de Graaff, 60″ Cyclotron, 41″ Cyclotron and Tandem Van de Graaff facility. All of these accelerators are capable of producing radiation levels in excess of 100 rem h and the radiation safety systems are designed to prevent personnel from being exposed to high levels of radiation. (no refs.)

65688 Measurement and analysis of gamma-ray dose distribution in actual ship. H.Yamakoshi, K.Ueki, M.Nakata (Ship Res. Inst., Tokyo, Japan).
J. Nucl. Sci. & Technol. (Japan), vol.20, no.2, p.127-39 (Feb. 1983).
The gamma-ray dose distribution was measured in an actual ship to study the applicability of the point kernel method applied to the calculation of γ-ray dose distributions in ships. The measured distribution was used to verify the applicability of the Monte Carlo method. Monte Carlo analysis revealed that the γ-rays scattered back from the steel plates constructing the ship's hull increase their contribution to the measured dose value as the distance between the dose measuring point and the γ-ray source increases. It is also shown that the feasibility of applying Monte Carlo methods to the analysis of γ-ray dose distribution in ships will be enhanced remarkably by utilizing the function adopted in the subroutine RELCOL in the Monte Carlo code MORSE-CG and by applying the source direction biasing technique. (4 refs.)

65689 γ-radiation albedo of hydrogen-containing plane layers. V.I.Kulikov, K.K.Popkov.
Sov. At. Energy (USA), vol.53, no.2, p.553-4 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.102-3 (Aug. 1982). [received: April 1983]
The differential characteristics of the γ-radiation albedo of flat plates of various thicknesses made out of polyethylene, paraffin, Plexiglass, and layers of water are calculated with the help of the Monte Carlo method implemented in a previously published program. The statistical error of the calculations was 5-10% for the angular characteristics of the albedo and 5-30% for the spectroangular characteristics. (1 ref.)

65690 Fricke dosimetry in low dose range for food irradiation. T.Kume, H.Tachibana, M.Takehisa.
Report JAERI-M-82-100, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Aug. 1982), 20 pp.
In order to establish a suitable method of dosimetry in low dose range on food irradiation, the precision limit of the Fricke dosimeter (ferrous sulfate dosimeter) and the effect of water purification on Fricke dosimetry were investigated. At the dose range lower than 40 Gy, the errors of Fricke dosimetry are larger than 0.5% but does not exceed 2% at the dose as low as 15.5 Gy, whereas the errors are within 0.5% at more than 57.6 Gy. Among various kinds of water (tap-water, single distilled water, Milli-Q water and triply distilled water), Milli-Q water could be used for the Fricke dosimeter as good as triply distilled water. Milli-Q water is easily prepared in a short time from a Milli-Q system with the use of ion exchange cartridge and millipore filter. From these results, it has become apparent that Fricke dosimetry is applicable to low dose such as onion sprout inhibition (minimum dose 20 Gy). (8 refs.)

Identification of possible high integrity containers for low-level nuclear waste disposal .... See Entry 65405

Nuclear waste disposal: the interface between performance assessment and research ....See Entry 65408

Performance of asphalt and clay liners as a uranium mill tailings leachate barrier ....See Entry 65410

A comparative assessment of TRU waste forms and immobilisation processes ....See Entry 65411

Low-level waste disposal analysis .... See Entry 65412

Biological intrusion of low-level waste trench covers ....See Entry 65414

On-line measurements of the volatilisation of ruthenium in a vitrification process .... See Entry 65421

Bremsstrahlung beams from high-power electron accelerators for use in radiation processing ....See Entry 65802

A theoretical concept for measuring doses from external radiation sources in radiation protection ....See Entry 69028

28.90 OTHER TOPICS IN NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES

65691 Reactor engineering divison annual report. (April 1, 1981 - March 31, 1982).
Report JAERI-M-82-114, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Sept. 1982), 205 pp.
Research and development activities in the Division of Reactor Engineering in the fiscal year 1981 are described. The work of the Division is closely related to development of a multipurpose very high temperature gas cooled reactor and fusion reactors, and development of a liquid metal fast breeder reactor carried out by the Power Reactor and Nuclear Fuel Development Corporation. Contents of the report are achievements in fields such as nuclear data and group constants, theoretical methods and code development, integral experiment and analysis, shielding, reactor and nuclear instrumentation, reactor control and diagnosis, and fusion reactor technology, and activities of the Committee on Reactor Physics.

29.00 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS

29.10 PREACCELERATION (INJECTION)

65692 A 550 MeV injector microtron for MAX. M.Eriksson (MAX-lab, Lund, Sweden).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.144-9 vol.1
An accelerator system called MAX is currently being built at the university in Lund. The accelerator system will be used both as a continous electron source for nuclear physics and as a synchrotron light source. The system will consist of an existing 100 MeV race-track microtron, which will be used as an injector, and a 550 MeV storage ring/pulse-stretcher, which just now is being built. (no refs.)

Status of the VICKSI accelerator facility and its improvement by the addition of a tandem .... See Entry 65698

Improvement of the energy spectrum in standing wave accelerators by delaying injection .... See Entry 65715

The MAX-project ....See Entry 65733

Acceleration of polarized deuterons at the synchrophasotron from the source 'POLARIS' .... See Entry 65744

The EBIS-RFQ couple: a fully matched heavy ion 3rd pre-injector and Saturne ....See Entry 65783

Application of multiply charged ions to small accelerators ......See Entry 65790

29.15 ELECTROSTATIC AND LINEAR PARTICLE ACCELERATORS

65693 Coming in close with Minac [nuclear power plant radiography]. A.H.Cordova (Electric Power Res. Inst., Palo Alto, CA, USA).
EPRI J. (USA), vol.8, no.2, p.18-19 (March 1983).
Describes a miniature linear accelerator which can perform X-ray inspections of thick-section components in the tightest quarters while the nuclear power plant is in operation. (no refs.)

65694 Impact of accelerators on US science, technology, and productivity. J.E.Leiss (Office of High Energy & Nuclear Phys., US Dept. of Energy, Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1353-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The invention and continued development of particle accelerators and the associated technology have had profound impact upon many subfields of pure and applied science and upon the overall US technological capabilities. Accelerators have also found extensive application in industry to produce either new products, better products, or products at lower cost. There is great potential for science to contribute to our long term economic growth and improved productivity through aggressive development of high-technology industries. Opportunities for application of accelerators in these high technology industries exist and should be exploited. This explotation would be aided by improved cooperative efforts between industry, universities, national laboratories, and government. (no refs.)

65695 University-industry research collaboration. Wei-Kan Chu (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1357-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Research and development efforts made by government, private industry and universities have transformed the United States into a major power in the world in science and technology. But our commitment in R&D has slipped in the past few years. There are growing problems in the composition of the science-engineering work force as well as our productivity. Possible long-term consequences of this worsening situation are predictable. Since government reduction in research spending plus inflation are eroding potential education and research funds, university-industry collaboration becomes a necessity for maintaining the research activities and to reverse the worsening trend. The necessity of collaboration is well recognized by industries as well as by academia. However, the implementation of university-industry collaboration is non-trivial. What universities want is research funding with freedom to spend it. What industries want is research results which can directly apply to the innovation of new and improved products and technology, plus a continuous flux of graduating young blood to inject into industries. The author emphasizes the crisis in R&D with cold statistics. He stresses the need of university-industry collaboration and summarizes and comments on some of the suggestions made to universities as well as to industries as examples in this type of collaboration. (no refs.)

65696 Initial operation of the Holifield facility. J.B.Ball (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1363-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The author reports on the present status of facility operation, observations from testing and running of the 25 MV Pelletron, experience with coupled operation of the Pelletron with the ORIC booster, and a brief summary of the experimental devices now available at the facility. (2 refs.)

65697 Quantitative radioisotope measurements with the NSF-Arizona regional accelerator facility. T.H.Zabel, A.J.T.Jull, D.J.Donahue, P.E.Damon (Univ. of Arizona, Tucson, AZ, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1371-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Results of tests on the tandem accelerator mass spectrometer (TAMS) at the University of Arizona are presented. These results demonstrate: (a) measurements of $^{14}C/^{13}C$ ratios with precisions of a few percent can be made in a period of one to several hours; (b) measurements with precisions of 0.5% have been made in which the uncertainties were mainly statistical and in which contributions to the uncertainty of machine fluctuations were negligible; (c) precise measurements of the ratio of $^{14}C/^{13}C$ in samples of NBS oxalic acid and of 1890 wood are consistent with the accepted value of that ratio; (d) the real signal from a 44000 year old sample is equal to the background rate produced from a dead carbon sample. In addition, results of some measurements on archaeological samples are presented. (4 refs.)

65698 Status of the VICKSI accelerator facility and its improvement by the addition of a tandem. P.Arndt, W.Busse, B.Martin, R.Michaelsen, W.Pelzer, D.Renner, B.Spellmeyer, K.Ziegler (Hahn-Meitner-Inst. for Kernforschung Berlin GmbH, Berlin, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1374-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A general description of the VICKSI accelerator facility is given including its experimental facilities. Its operation and its operational limits are explained as well as the improvements of VICKSI by the addition of an 8 MV tandem as alternate injector. The status and timetable for the tandem project is given. (11 refs.)

65699 Examples of fundamental research and applications at small accelerators. A.Ferle-Vidovic, S.Kaucic, T.Lechpammer, M.Osmak, D.Petrovic, D.Rendic, I.Slaus (Ruder Boskovic Inst., Zagreb, Yugoslavia).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1377-80 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Accelerators are facilities where fundamental research and applications develop jointly. The following are examples of an interplay between fundamental research and applications: 1. Evidence for the three body force (3BF) derived from neutron-neutron (n-n) scattering length data and nuclear data for science and technology. 2. Absence of nucleoside repair effects for neutron irradiation and the development of the neutron radiobiological facility. 3. Mathematical modeling and production of radiopharmaceuticals. (25 refs.)

65700 The Advanced Test Accelerator—a high-current induction LINAC. E.G.Cook, D.L.Birx, L.L.Reginato (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1381-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The Advanced Test Accelerator (ATA) is a linear induction accelerator being built at Lawrence Livermore National Laboratory. The aim of the ATA, together with its associated physics program, is the research and development necessary to resolve whether particle-beam propagation is possible. Since the accelerator is the tool needed to do the basic propagation experiment, many of its design parameters are specified by the physics. The accelerator parameters are: 50 meV, 10 kA, 70 ns pulse width (FWHM), and a 1 kHz rep-rate during a ten-pulse burst. In addition, beam quality and pulse-to-pulse repeatability must be excellent. The unique features of the accelerator are the 10 kA beam and the 1 kHz burst frequency. (9 refs.)

65701 PHERMEX standing-wave linear electron accelerator. T.P.Starke (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1402-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The PHERMEX standing-wave RF electron linac is a high-current pulsed electron beam generator that is used for flash X-radiography. This accelerator is being upgraded to 1000-A peak current and 50-MeV peak energy over a 150-ns pulse or over three 40-ns pulses. This upgrade is a result of increasing the RF power in the cavities and installing a new (Physics International) injector pulser. (3 refs.)

65702 A high-brightness negative hydrogen linear accelerator. E.A.Wadlinger, J.A.Farrell, H.O.Dogliani.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1408-11 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The authors have designed a linear accelerator to accelerate negative hydrogen ions to 50 MeV with an instantaneous output current of 100 mA and a normalized RMS emittance in both transverse planes of $0.02\cdot\pi$ cm.mrad. The design and results obtained to date with a 2-MeV prototype are presented. (11 refs.)

65703 Our development in small industrial accelerators. Zhou Qi Zhang (Accelerator Res. Inst., Shanghai Electrical Machinery Corp., Shanghai, China).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1412-14 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Accelerators used as a tool in industrial manufacturing processes are being developed successfully and rapidly. The author introduces the development in small accelerators used in the field of industries during the past 20 years. (no refs.)

65704 Low-energy, high-current proton accelerators at CRNL. M.S.de Jong, J.C.Brown, B.G.Chidley, L.D.Hansborough, R.M.Hutcheon, G.E.McMichael, S.O.Schriber, M.R.Shubaly, R.B.Turner, J.Ungrin (Chalk River Nuclear Labs., Res. Co., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1415-17 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
During development studies leading to operation of a 300 mA, 10 MeV proton linac in 1990 (the first stage of an accelerator breeder) several 100% duty cycle proton linacs will be built and tested to determine design limitations and operating characteristics. Presently a 750 kV injector and a 270 MHz drift-tube linac are being used to accelerate several mA of protons to 3 MeV in tests of high power operation. The first of the new linacs will be a 75 mA, 600 keV radiofrequency quadrupole structure. After initial operation an improved drift-tube linac will be added to accelerate the beam to 2.5 MeV. All of these 100% duty cycle proton linacs will have beams that could be used for radiation damage, beam diagnostic development, high-current beam-loss damage, beam dump design and transmission studies. The accelerator development program will be described as well as the possible practical uses for the proton beams. (12 refs.)

65705 A compact 6 MeV pulsed electron accelerator. R.M.Hutcheon, L.W.Funk, B.A.Gillies, S.B.Hodge, P.J.Metivier, S.O.Schriber (Chalk River Nuclear Labs., Res. Co., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1418-20 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A compact 6 MeV electron accelerator has been built and tested. The unit uses an axially coupled S-band standing wave structure driven by a magnetron source that delivers a 2 MW peak power, 4 μs pulse at 300 pps. The structure (including gun and high voltage feedthrough) is 12 cm diameter and 90 cm long. The gun is a novel telefocus design. The electron source is a 5.5 mm diameter loop of carburized thoriated tungsten wire in an electrode-focus coil geometry that produces a 40 keV input beam of ≤ 30 πmm mrad emittance at 25 mrad convergence half-angle. The gun is rugged, insensitive to mechanical shock, and requires only 7 watts of filament power to achieve 400 mA emission under operating pressures. the whole accelerator-gun package can be baked at 350°C, although a base pressure of 3×10^{-7} Pa is achieved with 24 hours of bakeout at only 150°C. At an output current of 100 mA (peak) in the pulse, the beam produces dose rates of more than 300 RMM on axis when using a 4 mm copper bremsstrahlung target. This roughly translates into a clinical flattened dose rate of 200 RMM over a 35×35 cm field. The accelerator package is straightforward to manufacture and could easily be reduced in length for specific applications. (6 refs.)

65706 Status of the 45 MeV proton LINAC at NEN. W.G.Mourad, R.F.Lankshear (New England Nuclear Corp., N Billerica, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1421-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Current status of the 45 MeV proton LINAC at NEN is described. Brief review of the major milestones is given. Operational experience with the injector, LEBT and other systems is reviewed. New systems that have been added over the past year are described and recent results are given. (8 refs.)

65707 Improved four-stage accel-decel production of low energy highly stripped heavy ions. P.Thieberger, J.Barrette, B.M.Johnson, K.W.Jones, M.Meron, H.E.Wegner (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1431-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The two model MP Tandem Van de Graaff accelerators at Brookhaven have been used in a four-stage accel-decel configuration to produce highly stripped

low energy heavy ions. The performance in this mode of operation has now been substantially improved by modifications of the second accelerator. The inclined field acceleration tube electrodes at the exit of this accelerator were replaced by straight electrodes, the vacuum was improved and the maximum negative thermal potential was increased. Higher intensity beams of heavier highly stripped ions can now be produced at lower energies than before. (5 refs.)

65708 Electron LINAC for laser and radiographic applications. W.E.Stein (Industrial Radiation Inc., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1434-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
New electron linear accelerator configurations have been designed and a few have been constructed to satisfy the needs of unique laser and radiographic applications. In the laser applications, electron linacs are required that produce exceptional electron beam quality. For adequate gain in the free-electron-laser experiments, 20-MeV electron beams with excellent emittance, low energy spread and high instantaneous current are essential. Similar beam quality from a 5-MeV linac is required to provide high efficiency and high repetition rate pumping of KrF or XeF gases in future excimer lasers. For radiography, new electron linacs with a variety of energies and intensities are required for special applications. Two diverse examples of custom linacs that have been requested and for which conceptual designs have been completed are: 1) a 10-MeV linac operating with an X-ray dose rate of 3000 R/min at 1 m while being subjected to extreme centrifugal and vibrational forces, 2) a light weight, highly portable 8-MeV linac with a dose rate of about 200 R/min at 1 m for X-ray and possibly neutron radiography in adverse environmental conditions at remote locations. (4 refs.)

65709 Low energy positron production at the Livermore LINAC. R.H.Howell, R.A.Alvarez (Lawrence Livermore Nat. Lab., Livermore, CA, USA), K.A.Woodle, S.Dhawan, P.O.Egan, V.W.Hughes, M.W.Ritter.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1438-41 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Beams of monoenergetic positrons with energies of a few eV to many keV have been used in experiments in atomic physics, solid state physics and materials science. The results of some of these experiments are given and the production of positron beams from a new source, an electron linac, is described. Intense, pulsed beams of low-energy beam from an electron linac. The production efficiency for low-energy positrons has been determined for electrons with energies from 50 to 120 MeV. Low-energy positron beams produced with a high energy electron a linac can be of much higher intensity than those beams produced with a high energy electron a linac can be of much higher intensity than those beams currently derived from radioactive sources. These higher intensity beams will make possible positron experiments previously infeasible. (12 refs.)

65710 A new type of charging belt for Van de Graaff accelerators. M.D.Strathman (Lawrence Berkeley Lab., Berkeley, CA, USA), E.Norbeck.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1502-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A Poly-C belt is installed on the AK-2000 accelerator at LBL which has been converted for use as an MeV electron source. Several anomalies are found when the belt was used to carry electrons rather than positive charge. Among these anomalies are: (1) the inability to maintain a given upcharge current for a fixed spray voltage, (2) a reduced charge carrying capability, and (3) a tendency to break into self-charge (>100 μA) when the spray voltage is raised to a large value and then reduced to zero. It is hypothesized that these anomalies, which occur when the belt is used to carry electrons, may contribute to the excellent characteristics of the Poly-C belt when it is used to carry positive charge. To alleviate these problems in the electron machine the spray supply is moved to the terminal and used to carry positive charge away from the terminal. When implemented in this fashion no problems are experienced with the belt. The Poly-C belt is an attractive replacement for the old HVEC belt. It exhibits better electrical stability and current carrying capacity, does not absorb moisture and should have a longer lifetime than the old style belts. (1 ref.)

65711 The Chalk River Electron Test Accelerator: a prototype for industrial irradiator designs. J.-P.Labrie, K.C.D.Chan, J.McKeown (Chalk River Nuclear Labs., Res. Co., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1634-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A CW electron linear accelerator is suggested as an efficient source of high power radiation for large scale material processing. Beams with a radiation equivalent greater than 5 MCi of ^{60}Co have been obtained with the Chalk River Electron Test Accelerator operating at 4 MeV and from simple scaling of the design concepts of the accelerator, radiation yields at least one order of magnitude higher can be confidently predicted. Research in window development is in progress. In a waste water treatment experiment, a 0.76 mm stainless steel window was used at a power dissipation of 1 W/mm^2 during a continuous 16 hour run without deterioration. In a separate facility, a 0.25 mm water cooled aluminum window designed to withstand 2 W/mm^2 is used to bring the electron beam into air. Results of electron beam distribution measurements in air are discussed. Recent technological developments both at Chalk River and at electron storage facilities using similar technology indicate that the CW electron linear accelerator will predominate in applications where beam powers greater than 200 kW are required. (12 refs.)

65712 Factors influencing the design of implanters for metal applications. P.H.Rose (Zymet Inc., Danvers, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1697-700 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The principal industrial use of accelerators at the present time is for implanting the silicon wafers used for making semiconductor devices. In the next few years the use of ion accelerators will extend to modifying the surface sensitive properties of other materials such as metals and ceramics. Exployment of an apparatus for a commercial usage makes the cost per operation the controlling parameter in machine design, and this in turn depends on the cost of the equipment, the throughput in units processed, and the reliability and quality of the product produced. The capital cost is only one of the factors to be considered. (8 refs.)

65713 Radio frequency characteristics of traveling wave accelerating sections calculated using a model resonator. V.F.Vikulov, V.E.Kalyuzhnyi.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1334-8 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2168-76 (Nov. 1982). [received: May 1983]
A model resonator for an accelerating section with a traveling wave is used to develop a technique for calculating the bandwidth (impedance) parameter of such sections and the field values and distribution over the cells in the sections for fixed generator power and cell parameters. Analytic expressions are derived for calculating the section cell parameters needed to produce a given field distribution at a specified frequency; analytic expressions are also derived for the optimal cell parameters in the wave type transformer and for the absorbing loads inside the waveguides to minimize reflections from the different sections within a frequency band. Practical recommendations are given for achieving these parameter values. (5 refs.)

65714 An accelerating section with a constant acceleration rate. A.I.Zykov, V.V.Kondratenko, G.D.Kramskoi, I.N.Mondrus, A.V.Ryabtsov, V.L.Smirnov, B.A.Terekhov, I.A.Chikatash.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1342-5 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2183-7 (Nov. 1982). [received: May 1983]
An accelerating section with varying cross section and $2\pi/3$ working oscillation phase has been designed, built, and tested. The experimental results at low powers in the acceleration mode are in satisfactory agreement with calculated results. (10 refs.)

65715 Improvement of the energy spectrum in standing wave accelerators by delaying injection. V.F.Vikulov, V.N.Zavorotylo, V.V.Ruzin, V.K.Shilov.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1345-7 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2188-91 (Nov. 1982). [received: May 1983]
Describes recent progress in the analytic and experimental study of injection pulse delay in terms of its effects on energy spread in the RELUS standing wave accelerator. The accelerators in the RELUS mode are designed to accelerate particles to 6 MeV at beam currents ≤ 100 mA per pulse; they are designed as a pair of high-Q accelerating sections in a biperiodic retarding system and are powered by a magneron across a 3-dB waveguide bridge. (6 refs.)

Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region .... See Entry 64587

Early electrostatic accelerators and some later developments ..See Entry 64644

Radiological safety of accelerators. A comparison of performance standards .... See Entry 65684

Some specialized radiological safety considerations at Argonne National Laboratory's Heavy Ion Research Facility (SAR, shielding design, QFs, HIRC) .... See Entry 65685

Radiation safety systems at Brookhaven National Laboratory's low-energy accelerators .... See Entry 65687

ALS II: the Saclay proposal for a 2 GeV, CW electron facility .... See Entry 65735

Acceleration of polarized deuterons at the synchrophasotron from the source 'POLARIS' .... See Entry 65744

Proton RFQ accelerator with high duty cycle .... See Entry 65775

RFQ1: a 600 keV, 75 mA CW proton accelerator .... See Entry 65776

High energy beam transport system for the 45 MeV proton LINAC at NEN .... See Entry 65777

Application of multiply charged ions to small accelerators ......See Entry 65790

Dynamic control of accelerator systems utilizing microprocessor technology .... See Entry 65792

A compact neutron source for research and industrial applications .... See Entry 65803

Studies for adjustable energy proton beams from proton linear accelerators .... See Entry 65806

Internal targets at Bates .... See Entry 65813

Performance of neutron radiography systems using particle accelerators .... See Entry 69001

The production of spallation radionuclides for medical applications at BLIP .... See Entry 69021

Therac 25: a new medical accelerator concept .... See Entry 69035

The changing role of accelerators in radiation therapy .... See Entry 69051

Precision measurements of rare radioisotopes with a tandem Van de Graaff accelerator .... See Entry 69372

29.20 CYCLIC ACCELERATORS AND STORAGE FACILITIES

(for plasma accelerators, see 52.75)

65716 Elimination of resonances by Siberian snakes. E.D.Courant (Brookhaven Nat. Lab., Upton, NY, USA).
AIP Conf. Proc. (USA), no.95, p.388-93 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Polarised particles in a circular accelerator or storage ring undergo spin precession. On an ideal orbit in a 'flat' ring this leads to a spin precession frequency $\nu_p = \gamma G$ where G is the magnetic moment anomaly. There is a way to make the precession frequency essentially independent of energy instead of increasing with energy. This is the introduction of 'Siberian snakes'. A Siberian snake is a device, consisting of a sequence of horizontal and vertical deflecting magnets inserted into a straight section, which rotates the spin by 180 degrees about a horizontal axis. It causes the orbit to snake around; the magnets must be such that the net deflection of the orbit by the snake is zero. The author discusses the elimination of resonances by two types of snakes: Cobra and Sidewinder. (6 refs.)

65717 Report on 'The workshop on polarized electron acceleration'. G.-A.Voss (DESY, Hamburg, Germany).
AIP Conf. Proc. (USA), no.95, p.394-9 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The workshop on polarized electron acceleration and storage was sponsored by the 'International Committee for Symposia on High Energy Spin Physics' and took place at DESY in March of 1982. The purpose of the workshop was to reach a better understanding of the dynamics of spin polarization in large electron storage rings. In these machines natural polarization can develop as a consequence of an effect first described and analyzed by Sokolov and Ternov in 1963: The emission of photons by the accelerated electrons (synchrotron radiation) can be accompanied by a spin flip of the electron. The spin of

these particles can only be parallel or antiparallel to the magnetic guide field. Synchrotron radiation accompanied by a spin flip of the emitting electron favors the direction from the higher to the lower energetic state. (no refs.)

65718 Polarized beam at the AGS. L.G.Ratner (Brookhaven Nat. Lab., Associated Univ. Inc., Upton, NY, USA).
AIP Conf. Proc. (USA), no.95, p.412-18 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The AGS is designed to accelerate over 10^{10} polarised protons per pulse with a polarisation higher than 60% to an energy of 26 GeV. The author discusses the plans and status of the AGS polarised beam with reference to the following: polarised proton source; RFQ preaccelerator; low energy beam transport; polarimeters; resonance jumping devices; instrumentation and control. (7 refs.)

65719 Present status of polarized proton beam at KEK. S.Hiramatsu, D.Arakawa, S.Fukumoto, Z.Igarashi, K.Ikegami, T.Kato, J.Kishiro, T.Kawakubo, C.Kubota, Y.Mori, K.Muto, H.Sato, A.Takagi, E.Takasaki, T.Takenaka (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan), K.Imai, N.Tamura.
AIP Conf. Proc. (USA), no.95, p.419-23 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The project of acceleration of the polarized proton beam at 12 GeV proton synchrotron of KEK is now in progress. The construction of the new preaccelerator of 750 keV for the polarized H^- ion source and the new LEBT from the new preaccelerator to the linac started in 1980. The H^- injection system for the 500 MeV booster synchrotron is also under construction. The authors are also constructing now the polarimeters and pulsed quadrupole magnets and improving the control system of the orbit correction for the main synchrotron. The 20 MeV H^- ion beam accelerated by the linac is sent to the booster. In the booster H^- ion is converted to proton by the charge-exchange injection. During the acceleration in the booster, two depolarizing resonances, one intrinsic and one imperfection, have to be passed through. These two resonances will be passed through by spin-flip, so called adiabatic slow resonance passage. (4 refs.)

65720 Polarization at LEP. B.W.Montague (CERN, Geneva, Switzerland).
AIP Conf. Proc. (USA), no.95, p.424-9 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
With the increasing understanding of spin motion in e^+e^- storage rings over the last few years, prospects for obtaining polarized beams in LEP have improved. Although depolarizing resonances still present a major problem, some practical experience, together with recent theoretical advances, make their compensation appear more tractable than previously believed. By making relatively modest provisions in LEP it is hoped that transversely-polarized beams will be demonstrable at around 50 GeV during Phase I operation. In the higher energy range, where requirements become more stringent, the practicability of polarized beams is still uncertain. (9 refs.)

65721 HERA plans. K.Steffen (DESY, Hamburg, Germany).
AIP Conf. Proc. (USA), no.95, p.430-41 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
In the HERA ep collider, longitudinal electron polarization is required at collision. A pair of spin rotators turns the spin from its vertical orientation in the arc into the longitudinal at the interaction point and vice versa. Different types of spin rotators are reviewed, with corrections for off-energy operation, and spin matching conditions are discussed which the linear optics design must meet in order to avoid radiative depolarization. Results for a matched optics example are given. (10 refs.)

65722 Spin matching for polarized protons. A.W.Chao (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA, USA).
AIP Conf. Proc. (USA), no.95, p.458-60 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Suggests a possible way to accelerate polarized protons. The basic data is borrowed from the works done on electron storage rings. The jargons involved are 'spin transparency' and 'spin matching', etc. In the proton language, the question being asked is what are the conditions on the accelerator lattice that make the depolarization resonance widths $\varepsilon=0$. Suppose one can 'spin match' the lattice so that at the moment of crossing a resonance during acceleration, the resonance being crossed is made to have zero width, then there will be no loss of polarization due to the resonance crossing. The author has listed the conditions for eliminating the widths of various depolarization resonances. These conditions are called the 'transparency conditions'. (9 refs.)

65723 Generalized Froissart-Stora formula. A.Turrin (Inst. de Fisica, Univ. di Roma, Roma, Italy).
AIP Conf. Proc. (USA), no.95, p.461-3 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
In a previous paper (1970) the author has developed an extension of the Froissart-Stora (1960) formula, which allows one to calculate the effect, on polarization, of the finite betatron tune-jump magnitude, ΔQ, in crossing rapidly an intrinsic depolarization resonance during acceleration in synchrotron. In that paper, the author has chosen a betatron tune-jump of the form $\dot{\chi}/\omega_0=-(\Delta Q/2)\tanh(\alpha t)$, which is symmetric in time, thereby excluding the conditions encountered in cases where the spread in Q, $G\Delta\gamma$, due to the γ spread, $\Delta\gamma$, of the beam is comparable with the applied range, ΔQ. So, it is to the analysis with replacement of the symmetric Q-jump above by an asymmetric one, namely $\dot{\chi}/_0=G(\bar{\gamma}-\gamma_{res})-(\Delta Q/2)\tanh(\alpha t)$, that the author has addressed the present work. Here, $\bar{\gamma}$ is the relativistic energy factor of any (selected) group of off-momentum particles having the same energy. (4 refs.)

65724 Studies of ion beam-photon interactions at the National Synchrotron Light Source. K.W.Jones, B.M.Johnson, J.B.Hastings, M.Meron (Brookhaven Nat. Lab., Upton, NY, USA), V.O.Kostroun, T.H.Kruse.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1026-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
To date, synchrotron radiation has been used for atomic physics experiments with gas or vapor targets. Experiments with crossed or merged ion and photon beams are made possible by the advent of high-brightness synchrotrons such as the National Synchrotron Light Source. Some types of experimental programs which can now be pursued are considered. Design parameters for a proposed ion-photon beam apparatus are discussed. (16 refs.)

65725 Research using synchrotron radiation at the National Synchrotron Light Source. W.Thomlinson (Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1030-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The National Synchrotron Light Source (NSLS) is now becoming operational with synchrotron radiation experiments beginning on the 700 MeV VUV electron storage ring. Commissioning of the 2.5 GeV X-ray storage ring has also begun with the experimental program expected to begin in 1983. The current status of the experimental program and instrumentation, and the plans for future developments, are discussed. Although some early results have been obtained on VUV beam lines no attempt is made to describe them. Instead, an overview of the beam line characteristics is given, with an indication of those already operational. (18 refs.)

65726 The Texas A&M coupled-cyclotron system. B.Laune, D.May, D.H.Youngblood (Cyclotron Inst., Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1367-70 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A superconducting cyclotron of the Michigan State University design having $K=500$ and $K_F=160$ is under construction at Texas A&M and will be used both alone and as a heavy-ion injector for the existing 224-cm cyclotron. The heavy-ion performance of the completed facility is compared with some other US facilities. Good intensity beams of lighter ions ($A<40$) above sonic velocity will be avaiable with beams above the Coulomb barrier available throughout the periodic table. Deuterons and alpha particles to 80 MeV/nucleon will be available from the cyclotron, while up to 55 MeV protons, up to 130 MeV ^{3}He ions and polarized protons, deuterons, and ^{3}He ions will remain available from the present cyclotron. (4 refs.)

65727 Progress on the NBS-LANL CW microtron. P.H.Debenham, S.Penner, R.L.Ayres, R.I.Cutler, E.R.Lindstrom, D.L.Mohr, J.E.Rose, M.A.D.Wilson (NBS, Washington, DC, USA), L.M.Young, R.E.Martin, A.Mitra, J.M.Potter, R.H.Stokes, P.J.Tallerico, L.Wilkerson.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1391-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The NBS-LANL racetrack microtron (RTM) currently under construction at the National Bureau of Standards is a demonstrated accelerator to determine the feasibility of, and to develop the technology necessary for building high-energy, high-current, continuous beam (CW) electron accelerators using beam recirculation through room temperature RF accelerating structures. Parameters of the RTM are: injection energy—5 MeV; energy gain per pass—12 MeV; number of passes—15 or 16; final beam energy—185-197 MeV; maximum current—550 μA; RF frequency—2380 MHz. At present, the electron gun and 100 keV beam transport line are operational, and most other major subsystems are in the construction or installation phase. Exceptions are the RF structure (under development), the 5 MeV beam transport line (in engineering design), and the extraction beam line (in conceptual design). (11 refs.)

65728 Betatrons with kiloampere beams. J.M.Peterson (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1396-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Although the magnetic-induction method of acceleration used in the betatron is inherently capable of accelerating intense particle beams to high energy, many beam-instability questions arise when beams in the kilo-ampere range are considered. The intense electromagnetic fields produced by the beam, and by the image currents and charges induced in the surrounding walls, can produce very disruptive effects. Several unstable modes of collective oscillation are possible; the suppression of any one of them usually involves energy spread for 'Landau damping' and careful design of the electrical character of the vacuum chamber. The various design criteria are often mutually incompatible. Space-charge detuning can be severe unless large beam apertures and high-energy injection are used. In order to have an acceptably low degree of space-charge detuning in the acceleration of a 10-kilo-ampere electron beam, for example, a1. injection energy on the order of 50 MeV seems necessary, in which case the forces due to nearby wall images can have a larger effect than the internal forces of the beam. (no refs.)

65729 JSW's BABY CYCLOTRON. Y.Toda, Y.Satoh, Y.Kaneda, I.Suzukawa, T.Yamada (Accelerator Group, Muroran Plant, Japan Steel Works Ltd., Muroran, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1405-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Designed by The Japan Steel Works Ltd., specially for installation in a hospital's medical department and nuclear research laboratory, 'JSW BABY CYCLOTRON' has been developed to produce short-lived radioisotopes such as ^{11}C, ^{13}N, ^{15}O and ^{18}F. JSW's Baby Cyclotron has some design features. 1) Fixed energy and four sector azimuthally varying field. 2) Compact figure desired for hospital's nuclear medical department. 3) A bitter type magnet yoke shielding activity. 4) Simple control and operation. 5) Easy maintenance without skilled personnel. (no refs.)

65730 Microprogrammable processor ESOP in a small angle elastic scattering experiment. R.Birsa, F.Bradamante, S.Dalla Torre, M.Giorgi, L.Lanceri, A.Martin, P.Moras, A.Penzo, P.Schiavon, A.Villari.
Report INFN/AE-82/10, Ist. Naz. Fis. Nucl., Trieste, Italy (1 Sept. 1982), 16 pp.
The microprogrammable processor ESOP has been introduced in the trigger system of a small angle elastic scattering experiment on a polarised proton beam at the Saturne synchrotron. The authors describe its implementation in a data acquisition system based on a Hewlett-Packard computer and present some preliminary results on the performance of a straight tracks rejecting algorithm. (9 refs.)

65731 Magnetic forces on the coils of the Superconducting Cyclotron at the University of Milan. E.Fabrici.
Report INFN/TC-82/10, Ist. Naz. Fis. Nucl., Milan, Italy (19 July 1982), 20 pp.
A three sectors cyclotron with superconducting coils is now under construction at the University of Milan. The machine covers a wide range of energies and ions, the maximum design energies being 100 MeV/n for fully stripped light ions and 20 MeV/n for the heaviest ones, corresponding to a K_{foc} equal to 200 MeV and K_b equal to 800 MeV respectively. The machine design and the expected performances are presented in detail. An important issue in designing superconducting coils for a cyclotron is to estimate with some accuracy the forces acting on them, in particular those arising from centering errors etc. These calculations are usually plagued by a number of uncertainties. Some effort has been made in order to narrow down the error limits, and this paper reports briefly on the results. They concern: the axial forces arising in an ideal situation, i.e. when the coils are perfectly centered with respect to the iron structure, and the axial and radial forces arising from errors in the coils positioning. (7 refs.)

65732 Use of electron rings in nuclear physics research. J.S.O'Connell (Center for Radiation Res., NBS, Washington, DC, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.1-3 vol.1
The author outlines how the developments in accelerators have improved our understanding of nuclear and elementary particle physics and speculates on how future advances in these fields will be linked. (no refs.)

65733 The MAX-project. B.Forkman (Dept. of Phys., Univ. of Lund, Lund, Sweden).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.47-51 vol.1
The accelerator system MAX consists of a 100 MeV injector race-track microtron and a 550 MeV pulse-stretcher/storage ring. As the accelerator system is designed in two planes, the injection microtron can be used for isotope production, radiography or, eventually, as an electron source for a free electron laser working in the IR region, while the ring is operated in its storage mode. For nuclear research experiments, a short (1 μs) microtron pulse will be injected from below into the ring. A slow extraction scheme will be used to get an almost continuous beam down to the lower plane where the nuclear research experiments will be carried out. In the storage mode, the ring will be filled with electrons which will be accelerated up to the maximum energy of 550 MeV. The upper plane will be used mainly for synchrotron light experiments. (1 ref.)

65734 Experience with a 150 MeV pulse stretcher ring SSTR. T.Tamae, O.Konno, M.Mutoh, K.Yoshida, T.Tanaka, T.Sasanuma, Y.Shibazaki, S.Urasawa, T.Terasawa, K.Yamada, T.Kurihara, T.Ichinohe, S.Takahashi, Y.Kawazoe, H.Miyase, M.Sugawara (Lab. of Nuclear Sci., Tohoku Univ., Sendai, Japan).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.52-9 vol.1
Operating experiences with a 150 MeV pulse stretcher ring is described. Since December 1981, test operation has been performed using a short beam pulse (20 nsec) to study the monochromatic beam extraction. Initially observed broadening of the extracted beam has been attributed to a coupled resonance between the horizontal and the vertical betatron oscillation. After readjusting the tune of the ring a 130 MeV, 1 μA electron beam has been obtained with 80% duty factor. The energy width of this extracted beam was measured to be 0.2%. (no refs.)

65735 ALS II: the Saclay proposal for a 2 GeV, CW electron facility. B.Aune, C.Grunberg, M.Jablonka, F.Koechlin, J.Magne, A.Mosnier, F.Netter (CENS, Gif-sur-Yvette, France).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.73-5 vol.1
Studies for the transformation of the ALS (600 MeV, 1% duty cycle) into a high energy, CW machine are currently being performed at Saclay. In order to use the greatest part of the existing facility, the solution of adding a stretcher ring to the linac (with new klystrons) has been chosen. (3 refs.)

65736 Storage rings with internal targets: design considerations. R.E.Pollock (Phys. Dept., Indiana Univ., Bloomington, IN, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.76-84 vol.1
The use of internal targets in stored beams of electrons or light ions offers many potentially attractive experimental advantages provided that the storage ring design accommodates this application properly. The experimenter typically demands: long, unencumbered straight sections with small, clean waists at the target position; access to reaction products emitted at small angles relative to the beam direction; variation in parameters to which the experiment may be sensitive such as dispersion and waist size; ready access to the ring interior for target changes, insertion of defining apertures; and so forth. On the other hand the ring designer seeks to minimize cost and complexity by: using repetitive lattice structures with high symmetry; avoiding the large chromaticity and other aberrations arising from tight waists in long straight sections; allowing little or no parameter variation; discouraging ring exposure to air to simplify the problem of maintaining a suitably high vacuum for a long beam lifetime, etc. (1 ref.)

65737 Remarks about a 'parasitic' 200 MeV electron ring. P.Carlos (CENS, Gif-sur-Yvette, France).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.137-43 vol.1 (1 ref.)

65738 Photonuclear research at the Bonn 500 MeV synchrotron. R.Stenz (Phys. Inst., Univ. Bonn, Bonn, Germany).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.209-18 vol.2
The performance of a tagged photon beam facility for the photon energy range 100 to 450 MeV is described. The first series of experiments has shown that the combination of a low background tagged photon beam and a large solid angle detector forms a valuable tool for the investigation of photonuclear processes. The accuracy of these experiments is still limited by technical problems. The next generation of electron accelerators will provide tagged photon beams with high energy resolution, reasonable intensity, and a precise normalization of the photon flux. This will remove the main obstacles preventing the exploitation of real photons as a clean probe. Future experiments will continue to explore the gross features of the photon nucleus interaction in the Δ-resonance region. The development of experimental techniques will concentrate on the identification of specific nuclear final states either by measuring the final nucleus in a track sensitive target or by detecting its low energy decay products. (15 refs.)

65739 The stretcher alternative: basic design considerations. B.Norum (Phys. Dept., Univ. of Virginia, Charlottesville, VA, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.265-74 vol.2
Design considerations for a pulse stretcher fall into two groups. The first are those determining the gross parameters of the system, that is the circumference, shape, and magnetic radius. The second group contains those which determine the optics of the machine, that is the tune, chromatic properties, extraction resonance, etc. The results of these two groups of considerations are strongly interrelated, but the factors which influence the former group are largely independent of those involved in the latter. It is generally safe, therefore, to consider them separately. (10 refs.)

Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region .... See Entry 64587

Workshop on SPS Fixed-Target Physics in the Years 1984-1989 (CERN-83-02) .... See Entry 64594

Radiological safety of accelerators. A comparison of performance standards .... See Entry 65684

Radiation safety systems at Brookhaven National Laboratory's low-energy accelerators .... See Entry 65687

A 550 MeV injector microtron for MAX .... See Entry 65692

Impact of accelerators on US science, technology, and productivity .... See Entry 65694

University-industry research collaboration .... See Entry 65695

Initial operation of the Holifield facility .... See Entry 65696

Status of the VICKSI accelerator facility and its improvement by the addition of a tandem .... See Entry 65698

Examples of fundamental research and applications at small accelerators .... See Entry 65699

Our development in small industrial accelerators .... See Entry 65703

Factors influencing the design of implanters for metal applications .... See Entry 65712

The acceleration of polarized protons .... See Entry 65740

Beam polarization at PETRA .... See Entry 65741

Crossing of depolarization resonances at Saturne (Saclay) .... See Entry 65742

Polarized proton and antiproton beams and experiments at the Tevatron .... See Entry 65743

The EBIS-RFQ couple: a fully matched heavy ion 3rd pre-injector and Saturne .... See Entry 65783

Dynamic control of accelerator systems utilizing microprocessor technology .... See Entry 65792

Internal targets at Bates .... See Entry 65813

Possibilities for internal tagging in the energy region 100-500 MeV at the accelerator system MAX .... See Entry 65814

Internal target experiments at an electron storage ring .... See Entry 65815

The Brookhaven medium energy gamma ray project .... See Entry 65817

A spectrometer coupled to an electron storage ring for tagging laser backscattered gamma rays .... See Entry 65822

Advanced medical accelerator design .... See Entry 69004

Design and status of a specialized cyclotron for positron tomography .... See Entry 69034

Installation and testing of a hospital based cyclotron for radiation therapy and isotope production .... See Entry 69049

A medical cyclotron, facilities and program at the King Faisal Specialist Hospital and Research Centre Riyadh, Saudi Arabia .... See Entry 69050

The changing role of accelerators in radiation therapy .... See Entry 69051

29.25 PARTICLE SOURCES AND TARGETS, PREPARATION AND TECHNOLOGY

(see also 07.77 Particle production and handling; targets)

65740 The acceleration of polarized protons. R.D.Ruth (Lawrence Berkeley Lab., Berkeley, CA, USA).
AIP Conf. Proc. (USA), no.95, p.378-87 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Introduces the problems of accelerating polarized protons (or other ions) to high energy. The author discusses a quantum mechanical style perturbation theory which is used for calculating the depolarisation due to passage through a resonance. He also considers the effects of overlapping resonances. (7 refs.)

65741 Beam polarization at PETRA. H.D.Bremer, K.Kewisch, H.C.Lewin, H.Mais, G.Ripken, R.Rossmanith, R.Schmidt (DESY, Hamburg, Germany), D.P.Barber.
AIP Conf. Proc. (USA), no.95, p.400-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The results of the polarization measurements at PETRA are described: the natural small degree of polarization in PETRA has been increased to up to 80 percent in a single beam by a special orbit correction program. Measurements have also shown that a strong beam-beam interaction can depolarize the beam and at 16.5 GeV the luminosity for polarized beams in a given optics is limited to approximately 4×10^{30} cm^{-2} sec^{-1}. In addition the first measurements of the depolarization by solenoids and the first calibration of the beam energy at PETRA by a depolarizer are described. (5 refs.)

65742 Crossing of depolarization resonances at Saturne (Saclay). E.Grorud, J.-L.Laclare, G.Leleux, A.Nakach, A.Ropert (Lab. Nat. Saturne, Saclay, France).
AIP Conf. Proc. (USA), no.95, p.407-11 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Presents the results of the 1981-1982 campaign of polarization measurements at Saturne. Resonance crossing techniques are given for each other of resonance. The adiabatic crossing of a resonance (spin flip) is proved to be reliable. (3 refs.)

65743 Polarized proton and antiproton beams and experiments at the Tevatron. A.L.Read (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
AIP Conf. Proc. (USA), no.95, p.442-4 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Describes a 200 GeV polarized proton (and antiproton) beam and experimental facility which will be built as part of the Tevatron II construction program at Fermilab. The beam is being developed by a joint Argonne-Fermilab team. The detector facility for the first experiments using the polarized beam is the responsibility of an Annecy-Argonne-Berkeley-Fermilab-Kyoto-Northwestern-Rice-Saclay-Serpukhov-Trieste collaboration. (no refs.)

65744 Acceleration of polarized deuterons at the synchrophasotron from the source 'POLARIS'. N.G.Anishchenko, A.M.Baldin, Yu.D.Beznogikh, V.P.Ershow, V.V.Fimushkin, V.A.Monchinsky, Yu.K.Pilipenko, Yu.I.Romanov, I.N.Semenyushkin, V.B.Shutov, A.Sulik, A.I.Valevich, L.P.Zinoviev (High Energy Lab., JINR, Dubna, USSR).
AIP Conf. Proc. (USA), no.95, p.455-9 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A cryogenic source of polarized deuterons POLARIS has been tested at the Dubna synchrophasotron for the program of research in the field of relativistic nuclear physics. The aim of the tests is to match the source with linac and

to accelerate a beam of deuterons. The set-up is described, and results of its operation along with the accelerator are presented. (3 refs.)

65745 **Polarization precession in quadrupoles and sextupoles.** D.Carey (Fermi Nat. Accelerator Lab., Batavia, IL, USA).
AIP Conf. Proc. (USA), no.95, p.454-7 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Lie algebraic techniques are applied to the precession of polarization in a magnetic field. The rotation matrix is represented as the exponential of an antisymmetric matrix. The equation of motion is derived as a series of commutators. The lowest order approximation gives the rotation in terms of the integral of the magnetic field along the particle trajectory. Higher-order terms yield rotations about the longitudinal axis. Explicit expressions are given for quadrupole and sextupoles. (no refs.)

65746 **Polarised targets—what is happening.** G.R.Court (Dept. of Phys., Univ. of Liverpool, Liverpool, England).
AIP Conf. Proc. (USA), no.95, p.464-72 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Reviews the current situation as regards polarised targets for use in external particle beams, from the point of view of the user—the high energy physicist. (11 refs.)

65747 **Dynamic polarization in some high-hydrogen glasses.** D.Hill (Argonne Nat. Lab., Argonne, IL, USA), M.Krumpolc.
AIP Conf. Proc. (USA), no.95, p.479-84 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Reports on a search for hydrogen-rich glasses suitable for forming solid solutions of Cr(V) complexes. The author discusses the existence of two large 'families' of glasses based on amines and ammonia obtainable with either borane-amine complexes or ammonium borohydride as 'vitrifying additives'. The glasses have hydrogen contents ranging up to at least 21 wt.%. Moreover, at least some members of these families yield sizeable dynamic nuclear polarizations when doped with sodium bis[2-ethyl-2-hydroxybutyrato(2-)]oxochromate(V) monohydrate, [EHBA-Cr(V)]. (1 ref.)

65748 **A frozen spin polarized proton target for use at LAMPF.** D.Hill, T.Kasprzyk, H.Spinka, S.Zelipsky (Argonne Nat. Lab., Argonne, IL, USA), J.J.Jarmer, J.Vaninetti.
AIP Conf. Proc. (USA), no.95, p.485-7 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A frozen spin polarized proton target has been developed and used at LAMPF to measure the spin correlation parameter A_{SS} for proton-proton elastic scattering. The target consisted of a horizontal dilution refrigerator, superconducting magnet, plus other equipment. The target refrigerator was fixed and the magnet moved on a rail system. The design permitted the same magnet to be used for both the polarizing and holding functions. In the holding configuration the magnetic field at the target was about 3 kG, and the open angular region for detecting scattered particles was 0° to 90° lab. With ethylene glycol target material a typical holding time of 500 hr was observed. (3 refs.)

65749 **Polarization measurements on irradiated ammonia.** P.R.Cameron, D.G.Crabb, S.L.Linn (Univ. of Michigan, Ann Arbor, MI, USA).
AIP Conf. Proc. (USA), no.95, p.488-91 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The polarization characteristics of ammonia irradiated at liquid helium temperatures and subsequently used in a scattering experiment are discussed. (4 refs.)

65750 **Horizontal dilution refrigerator for use in intense proton beams.** J.A.Bywater (Argonne Nat. Lab., Argonne, IL, USA), P.R.Cameron, D.G.Crabb.
AIP Conf. Proc. (USA), no.95, p.492-5 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A fast loading high-power horizontal dilution refrigerator insert has been built for use in the Michigan polarized proton target (PPT V). This PPT will be used in measurements of spin effects in high $P_\perp$ elastic p-p scattering at the Brookhaven AGS. The cooling power is compared with the existing interchangeable ^{3}He evaporation insert, and with similar dilution refrigerators at CERN and Bonn. The relative merits of these two types of refrigerators in absorbing the heat loads of high intensity beams is discussed. (11 refs.)

65751 **A frozen spin target with three orthogonal polarization directions.** R.Bernard, P.Chaumette, J.Deregel, R.Duthil, J.Fabre, C.Lesmond, G.Seite (CEN-Saclay, Gif-sur-Yvette, France), T.Niinikoski, J.M.Rieubland, J.Ball, P.Chesny.
AIP Conf. Proc. (USA), no.95, p.496-8 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A frozen spin target has been constructed at CEN-Saclay for nucleon-nucleon scattering experiments at the PS SATURNE II. The target which may have a maximum volume of 100 cm^3 is cooled in a vertical dilution refrigerator. The magnetic system is entirely superconducting and allows the polarization vector to be oriented in three orthogonal directions This target has been already used for the measurements of several parameters in the p-p scattering. (8 refs.)

65752 **A double target cell cryostat with quick interchange of target cells.** J.J.Jarmer, J.Vaninetti (Los Alamos Nat. Lab., Los Alamos, NM, USA).
AIP Conf. Proc. (USA), no.95, p.499-501 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A polarized target incorporating two target cells has been built and used in an experiment at LAMPF. Under cryogenic conditions either cell would be positioned on beam line in a few minutes permitting fairly rapid change over from one to the other. (1 ref.)

65753 **Ammonium borohydride—a novel, hydrogen-rich material for polarized targets.** M.Krumpolc (Univ. of Illinois, Chicago, IL, USA).
AIP Conf. Proc. (USA), no.95, p.502-4 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Preparation and properties of a novel, hydrogen-rich material, ammonium borohydride, NH_4BH_4 (24.5% H) are described. An ammonia solution of the hydride can be doped with the chromium(V) complexes and used for the preparation of polarized targets. (3 refs.)

65754 **Irradiated NH_3 and ND_2—two new target materials for polarized targets.** W.Meyer (Phys. Inst., Univ. Bonn, Bonn, Germany).
AIP Conf. Proc. (USA), no.95, p.505-11 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
A study of dynamic nuclear polarization (DNP) in NH_3 and ND_3 was made at the Bonn 2.5 GeV electron synchrotron. The paramagnetic radicals in the polycrystalline ammonia beads were created by irradiation in the high intensity 20 MeV electron beam ($>10^{14}$ electrons/sec) of the injection linac. During irradiation the ammonia beads, produced by dropping into liquid nitrogen, were cooled in liquid argon at ~90K. DNP measurements were performed at 1K, 0.5K and 0.2K in a 2.5 T magnetic field. Samples of NH_3, prepared in this way, yielded a maximum proton polarization of 66% at a temperature of 0.5K with a short polarization build-up time of 9 minutes. ND_3 could be polarized at a temperature of 0.2K up to 31%. The radiation resistance of the polarization of NH_3 is better than that of butanol. (23 refs.)

65755 **Present status of spin frozen deuteron target at KEK.** S.Hiramatsu, S.Isagawa, S.Ishimoto, A.Masaike, K.Morimoto (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
AIP Conf. Proc. (USA), no.95, p.512-14 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Brief report on the present status of a spin frozen deuteron target at KEK is presented. Deuterons in fully deuterated propanediol (D-8) with EHBA-Cr^V complex were polarized up to 40% in a high cooling power dilution refrigerator which was installed in a large aperture spectrometer. (4 refs.)

65756 **The ITEP polarized target installation for the study of interactions between hadrons and polarized protons at intermediate energies.** M.I.Bloodnishev, P.E.Budkovskii, V.M.Dobroc, V.P.Kanavets, I.I.Levintov, I.P.Marevichev, V.I.Martynov, B.V.Morozov, V.M.Nesterov, V.V.Rylstov, A.D.Sulimov, T.S.Cherkalina, A.V.Soskov, V.L.Hohlov (ITEP, Moscow, USSR).
AIP Conf. Proc. (USA), no.95, p.515-16 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The installation is designed for research of interactions between hadrons and polarized protons. It contains an ethylene glycol polarized target, a system of wire-spark detectors connected on-line with an EC-1010 computer, a system of scintillation and threshold Cherenkov counters for secondary particle separation. The spectrometric abilities of the installation are provided by the magnet of the polarized target with spark chambers in its field. Now it is located in a beam of the ITEP accelerator with particle momenta up to 2 GeV/c and is used for research of polarization in elastic pion-proton scattering. (no refs.)

65757 **Polarisation properties of irradiated ammonia (NH_3 and ND_3) at 1K and 25 kG.** H.Riechert (Phys. Inst., Univ. Bonn, Bonn, Germany).
AIP Conf. Proc. (USA), no.95, p.520-5 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Dynamic Nuclear Polarisation (DNP) of irradiated ammonia was examined in some detail at 1K and 25 kG. In continuation of earlier studies conducted in Bonn, it was attempted to gain information about the prevailing mechanism of DNP in this material. Therefore the frequency dependence of DNP in NH_3, of deuterons and unsubstituted protons in ND_3, as well as the polarising time τ and the relaxation time T_1 in NH_3 were measured. Also the shape of the deuteron polarisation signal observed in ND_3 is discussed. The polarisation measurements in ND_3 rule out the equal spin temperature (EST) behaviour of proton and deuteron DNP that is observed in most of the currently used target materials. It is attempted to explain the observations with a differential solid state effect model. Results of calculations for NH_3 and ND_3 incorporating the measured EPR-spectra are presented. (7 refs.)

65758 **Dynamic nuclear polarization of irradiated targets.** M.L.Seely, A.Amittay, M.R.Bergstrom, S.K.Dhawan, V.W.Hughes, R.F.Oppenheim, K.P.Schuller, P.A.Souder (Yale Univ., New Haven, CT, USA), K.Kondon, S.Miyashita, K.Morimoto, S.J.St. Lorant, Y.-N.Guo, A.Winnacker.
AIP Conf. Proc. (USA), no.95, p.526-33 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors have irradiated and studied dynamic nuclear polarization in ammonia, deuterated ammonia, butanol, borane ammonia, methylamine, ethane and lithium borohydride in order to test these substances for potential use as polarized target materials. These studies were conducted using a polarized target system operating at a temperature of 1K and a magnetic field of 5 T. The target system was set up on a beam line at the Stanford Linear Accelerator Center, enabling us to irradiate the targets in situ at 1K with a 6 to 20 GeV electron beam and to study their polarization properties simultaneously. Proton polarisations of ~70% and deuteron polarizations of ~25% were obtained in irradiated NH_3 and ND_3, with relatively short values of the polarizations growth time T_p. For both of these materials, the radiation resistance of the polarization was found to be approximately 30 times greater than for conventional chemically doped hydrocarbon targets. In the remaining irradiated materials tested, relatively small proton polarizations (~30% or less) were obtained and these materials do not seem to be suitable for polarized target applications. Irradiated NH_3 and ND_3, however, are very promising as practical polarized target materials. (7 refs.)

65759 **Workshop report on polarized proton ion sources.** V.W.Hughes (Yale Univ., New Haven, CT, USA).
AIP Conf. Proc. (USA), no.95, p.534-45 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The author presents a report on the developments in polarised proton ion sources. Current techniques in the production of polarised ion sources are reviewed with emphasis on the need to improve the quality of the sources. (25 refs.)

65760 **Spin-polarized hydrogen: new possibilities for polarized sources and targets.** D.Kleppner, T.J.Greytak (Dept. of Phys., MIT, Cambridge, MA, USA).
AIP Conf. Proc. (USA), no.95, p.546-65 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The creation of spin-polarized atomic hydrogen ($H\downarrow$) points the way to improved methods for producing polarized proton sources and targets. The systematics of $H\downarrow$ are reviewed and applications are outlined for an intense H^- source, a polarized atomic jet, and gaseous and solid targets. A technique is proposed for producing solid polarized deuterium for use in a fusion reactor plasma or as a polarized target. (24 refs.)

65761 **Solid state polarized electron sources.** M.Campagna, S.F.Alvarado (Inst. for Solid State Phys., KFA, Julich GmbH, Julich, Germany), F.Ciccacci.
AIP Conf. Proc. (USA), no.95, p.566-73 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The author reviews the progress achieved in our laboratory towards the further development of a nonmagnetic, solid state polarized electron source. Alloys of $Al_xGa_{1-x}As$ grown by molecular beam-epitaxy are shown to allow room temperature operation and generate polarized electrons by optical pumping at convenient wavelengths with polarization values in the range $P=45\%\pm1\%$. The performance of multilayers of GaAs-$Al_xGa_{1-x}As$ as photoemitters is also briefly described. Surface passivation of $Al_xGa_{1-x}As$ epitaxial layers is shown to be an efficient way for protecting the cathodes during exposure to atmosphere and allowing subsequent regeneration of the source parameters after ultrahighvacuum annealing. Ideas for further increasing the spin polarization P beyond the theoretical limit of 50%, valid for GaAs, are also discussed. (15 refs.)

65762 Polarized electron source for parity experiment at Bates. P.Souder (Yale Univ., New Haven, CT, USA), A.Barber, W.Bertozzi, G.Cates, G.Dodson, T.J.Gay, M.Goodman, V.W.Hughes, S.Kowalski, M.S.Lubell, A.Magnon, C.P.Sargent, R.Schaefer, W.Turchinetz, R.Wilson.
AIP Conf. Proc. (USA), no.95, p.574-9 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors are constructing a polarized electron source in order to study parity violation in elastic electron-carbon scattering at the MIT Bates Linac. The source uses a GaAs photocathode illuminated by light from an infrared krypton ion laser. Our design, which uses a multi-chamber vacuum system, meets the special requirements for operation at Bates. (12 refs.)

65763 A source of polarized electrons for a neutral current parity experiment. E.Reichert (Inst. for Phys., Univ. of Mainz, Mainz, Germany).
AIP Conf. Proc. (USA), no.95, p.580-5 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The author presents experimental details of polarised electron experiments at SLAC. The author describes the GaAs photocathode used and its operating characteristics. (5 refs.)

65764 Polarized photons for a measurement of parity violation in deuterium. A.B.McDonald, E.D.Earle, E.T.H.Clifford (Chalk River Nuclear Lab., Chalk River, Ontario, Canada).
AIP Conf. Proc. (USA), no.95, p.485-93 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors provide a general outline of the parity violation experiment and describe the development of the source of circularly polarized bremstrahlung. (14 refs.)

65765 A spin flipper for thermal atomic beams. G.Baum, W.Schrodger (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany).
AIP Conf. Proc. (USA), no.95, p.594-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The spin flipper presented here is based on the method of a diabatic passage. It allows for a rapid reversal of electronic as well as nuclear polarization of a thermal atomic beam without affecting beam intensity, beam profile, or magnetic fields in the interaction region. The flipper will be used in spin dependent measurements where industrial asymmetries and systematic errors have to be kept small. The spin flipper was tested with a polarized lithium beam in an atomic physics experiment and the reversal efficiency was found to be 0.98. The flipper can easily be adapted for other spin-polarizable atoms, e.g. for a polarized atomic hydrogen beam target. (5 refs.)

65766 Progress on producing polarized negative hydrogen ions by the ETHZ polarized ion source using the atomic beam method. P.A.Schmelzbach, W.Gruebler (Lab. fur Kernphys., Eidgenossische Tech. Hochschule, Zurich, Switzerland).
AIP Conf. Proc. (USA), no.95, p.604-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The progress on the ETHZ polarized negative hydrogen ion source, based on the atomic beam method, is described. Particular improvements have been made in the double charge exchange from positive to negative hydrogen ions. At present the source produces over 100 μA H^+ ions, which yields 5-6 μA polarized negative hydrogen ions. These ions have been accelerated in an EN tandem accelerator. A record current of 2-3 μA of polarized deuterons with 89% polarization could be focused through a 3 mm diameter collimator on a target. Further improvements incorporating presently available techniques are discussed. It is shown that 50-100 μA of polarized H^- and D^- ions can be produced with this type of source. (4 refs.)

65767 Status of the AGS polarized H^- source. A.Kponou, K.P.Schuler, V.W.Hughes (Yale Univ., New Haven, CT, USA).
AIP Conf. Proc. (USA), no.95, p.607-10 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Development of a polarized H^- source for the AGS polarized proton project, initially begun at Argonne National Laboratory in 1979, has been continuing at Brookhaven National Laboratory since early 1982. A description of the source is given and the status of the project is reviewed. (10 refs.)

65768 Recent development of optical pumping type polarized ion source at KEK. Y.Mori, K.Ikegami, A.Takagi, S.Fukumoto (Nat. Lab. for High Energy Phys., Ibaraki-ken, Japan).
AIP Conf. Proc. (USA), no.95, p.611-14 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors have constructed an ECR (electron cyclotron resonance) ion source to examine the characteristics and performance of the ECR ion source. It was found that this source was very suitable for an optical pumping type polarized ion source. They are now developing an optical pumping type polarized ion source. They are now developing a 16.5 GHz ECR ion source and constructing a new optical pumping type polarized ion source using this ECR ion source. In a preliminary experiment, they have already obtained the polarized H^- ion beam of 20~25 μA. (12 refs.)

65769 Improved Cs^0 source for the production of polarized H^- ions. T.Wise, W.Haeberli (Univ. of Wisconsin, Madison, WI, USA).
AIP Conf. Proc. (USA), no.95, p.615-17 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
The authors describe the production of a 3 μA DC beam of polarized H^- by ionization of polarized H^0 atoms with a 3 particle-mA Cs^0 beam of 40 keV energy. An improved Cs gun is described which yields 10 particle-mA Cs^0. (1 ref.)

65770 Counting a small number of radioactive atoms Monte Carlo program. K.T.Ekholm, A.M.Aurela (Wihuri Phys. Lab., Univ. of Turku, Turku, Finland).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.163-70 (April 1983).
The authors determine the posterior probability P_i that the rate of the production of specific radioactive atoms $R_i(i=1,...,N_R)$, assuming that the number of atoms is small ($\lesssim 100$) and the times of the pulses from the subsequent counting of decays are known. (5 refs.)

65771 Antiprotons at CERN. B.Southworth.
Endeavour New Ser. (GB), vol.7, no.1, p.19-23 (1983).
The unit of energy used in particle physics is the electronvolt (eV) which is the amount of energy picked up by an electron passing between the poles of a one-volt battery. Energies of a few eV are sufficient to pull electrons from atoms. Energies a million times higher (MeV) are involved when dealing with nuclear phenomena such as fission in reactors. To study the constituent particles of the nucleus, energies at least a thousand times higher still (GeV) are needed. The CERN antiproton project described here makes possible the highest collision energies ever achieved, but the total energy in the proton and anti-proton beams is still very small. What is important is that this energy is concentrated in a tiny amount of matter in the particle beam. (6 refs.)

65772 Uses of laser optical pumping to produce polarized ion beams. L.W.Anderson (Dept. of Phys., Univ. of Wisconsin, Madison, WI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1051-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Laser optical pumping can be used to produce polarized alkali atom beams or polarized alkali vapor targets. Polarized alkali atom beams can be converted into polarized alkali ion beams, and polarized alkali vapor targets can be used to produce polarized H^- or $^3He^-$ ion beams. The author discusses how the polarized alkali atom beams and polarized alkali vapor targets are used to produce polarized ion beams with emphasis on the production of polarized negative ion beams. (30 refs.)

65773 RISOAR: a facility for production of beams of radioactive ions. R.N.Boyd, L.Rybarcyk, M.Wiescher, H.J.Hausman (Dept. of Phys., Ohio State Univ., Columbus, OH, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1387-90 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A facility to produce beams of low energy and radioactive ions such as ^7Be, ^{11}C, ^{13}N, ^{15}O and ^{19}Ne is presently under construction at The Ohio State University. The beams, having expected intensities of order 1×10^6 ions/s and energies of 8 to 16 MeV, will be directed onto a hydrogen or helium gas cell, where the reaction products from proton or α-particle radiative capture reactions, or from particle transfer reactions, will be observed. The results of these reaction studies are of interest to fast nucleosynthesis, the mode of stellar environments surrounding an accreting neutron star, or in the region of a supernovae. The present paper describes the general operation of the facility as well as some of the details associated with specific sections of it. Also discussed is a time scale for completion of the project and initiation of the first experiments on it. (4 refs.)

65774 High current DC ion beams. M.R.Shubaly, M.S.de Jong (Accelerator Phys. Branch, Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1399-401 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Development of high-current CW accelerators such as ZEBRA and FMIT, use of high current DC ion beams in industry for sputtering and material treatment, and scientific applications such as heavy-ion fusion and plasma physics diagnostics have provided the impetus for ion source development programs at many laboratories. At Chalk River, development of efficient plasma generators and reliable extraction columns to provide high quality beams of hydrogen, nitrogen, argon and xenon is underway. DC beams of up to 850 mA (limited by available power supplies) of hydrogen, 200 mA of nitrogen, 155 mA of argon and 100 mA of xenon have been produced with good reliability. DuoPIGatrons, with and without magnetic cusps, are used to generate a high density, reasonably quiescent plasma. Multi-aperture accel-decel columns are used for extraction with shaped apertures and beamlet steering to improve beam quality. This paper describes the performance of these sources and identifies some of the remaining problems. Guidelines for extraction column design, and experience with transporting high current beams are also presented. (5 refs.)

65775 Proton RFQ accelerator with high duty cycle. A.Schempp, H.Deitinghoff, P.Junior, H.Klein (Inst. fur Angewandte Phys., Univ. Frankfurt/Main, Frankfurt/Main, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1425-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The radio frequency quadrupole accelerator concept uses RF fields for acceleration and focusing of low energy beams. The RFQ offers attractive features as the acceptance of a DC beam directly from the ion source and acceleration of intense beams with large space charge forces. The zero-made resonator design offers several advantageous properties, as simple construction, good RF behaviour and the possibility of very high duty cycle operation. A prototype proton accelerator for 10-360 keV (108.5 MHz) has been built and the status of this project will be reported. (13 refs.)

65776 RFQ1: a 600 keV, 75 mA CW proton accelerator. M.R.Shubaly, J.C.Brown, B.G.Chidley, M.S.de Jong, L.D.Hansborough, R.M.Hutcheon, G.E.McMichael, S.O.Schriber, R.B.Turner, J.Ungrin (Chalk River Nuclear Labs., Res. Co., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1428-30 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The RFQ1 accelerator is being built, as part of the ZEBRA program, to study the physics and engineering challenges of launching a moderate energy (600 keV), high current (75 mA) CW proton beam with good beam quality and reliability. The RFQ1 injector will provide a 50 keV proton beam with current variable from zero to ~125 mA at fixed energy and filling a defined ellipse in phase space. Design output current is 75 mA, however operation at higher current is anticipated. This paper describes the constraints on the design, the preliminary design and the present status of the project. (4 refs.)

65777 High energy beam transport system for the 45 MeV proton LINAC at NEN. W.G.Mourad (New England Nuclear Corp., N Billerica, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1442-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The high energy beam transport (HEBT) for the 45 MeV proton LINAC is described. Design objectives of an isotope production line and a beam dump line are discussed. Design criteria, beam degrading effects, misalignment, second order and higher effects are described, and preliminary test results are shown. (4 refs.)

65778 Vane coupling rings: a simple technique for stabilizing a four-vane radiofrequency quadrupole structure. D.Howard, H.Lancaster (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1446-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The benefits of stabilized accelerating structures, with regard to the manufacture and operation, have been well documented. The four-vane radiofrequency quadrupoles (RFQ) presently being designed and constructed in many laboratories are not stabilized because of the weak electromagnetic coupling between the quadrant resonators. This paper presents a simple technique developed at the Lawrence Berkeley Laboratory using vane coupling rings (VCRs) which azimuthally stabilize the RFQ structure and greatly enhance its use as a practical accelerator. (7 refs.)

65779 Intense neutron source. R.J.Walko, J.P.Brainard, A.A.Riedel, J.B.O'Hagen, F.M.Bacon (Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1449-52 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

A ScD_2 target film 5×10^{-5} m thick, tested in a UHV compatible 200 keV deuterium accelerator baked to 460°C, maintained a D-D neutron output rate of $1.0\text{-}1.2\times10^{11}$/s for 80 out of 140 hours of operation. This result demonstrates that a D-T neutron generator capable of a neutron output rate of 1×10^{13}/s and having a target lifetime suitable for cancer therapy is possible. Contrary to sputter rate data, ErD_2 target films appear to erode about twice as fast as ScD_2 films, making ErD_2 unsuitable as a target material. A low pressure ion source has been developed to replace the high pressure duopigatron. Experiments have verified that the single ring magnetic cusp ion source can deliver 200 mA of deuterium ions ($\approx$60% D^+) at 10-15 A of arc current with a background deuterium pressure of 0.26-0.40 Pa. This source will improve the safety of a D-T machine by reducing the tritium inventory by a factor of 6, and by utilizing the Zr-Al getter as the gas reservoir. (10 refs.)

65780 Reduction of ripple voltage in a Dynamitron. A.Langsdorf,J. (Phys. Div., Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1453-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

The author determines that a precise neutralization of the RF ripple voltage on the high voltage terminal of a Dynamitron has previously been prevented by a nonnegligible phase shift of RF currents in the two halves of the $\sim$100 kHz class C oscillator tank circuit, which is actually constituted of two slightly unequal high-Q coupled circuits because it has two ground points: the inescapable center-tap-ground in the capacitive legs and a center-tap-ground lead to the induction coil. The latter is needed to prevent damage by flashover transients; equivalent to its removal was the adjusting of RF ground return current to a null by aid of a current transformer on this lead and the suitable adjusting of trimmer capacitance. While the phase shift was thus held to a null, the actual ripple amplitude on the HV terminal was minimized by adjusting additional trimmer capacitances installed in the terminal of the machine. Then p/p 100 kHz ripple at 2 MV DC output was reduced to about 50 V and RMSD resolution by (p,γ) resonance threshold data near 1 MV was about 250 V. This limit to resolution has various causes including mechanical vibrations and unbalanced harmonics of the RF. (1 ref.)

65781 RFQ development at LBL. S.Abbott, D.Nrodzik, R.A.Gough, D.Howard, H.Lancaster, R.MacGill, S.Rovanpera, H.Schneider, J.Staples, R.Yourd (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1456-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

The radio frequency quadrupole (RFQ) is a structure which can efficiently focus, bunch and accelerate low velocity ion beams. It has many features which make it particularly attractive for applications in the biomedical and nuclear sciences. There are two projects in progress at LBL where the incorporation of heavy ion RFQ technology offers substantial benefits: in the upgrade of the Bevatron local injector, and in the design of the Bevatron local injector, and in the design of a dedicated heavy ion medical accelerator. In order to meet the requirements of these two important applications, a 200 MHz RFQ structure has been designed for ions with charge to mass ratios as low as 0.14, and a low RF power scale model has been built and tested. Construction of the high power model has begun. The status of this project is reviewed and a summary of technical specifications given. (8 refs.)

65782 Factors affecting the operating characteristics of the Zetatron: a small neutron generator for borehole logging. R.S.Berg, E.L.Jacobs (Tube Dev. Div., Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1459-62 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

The Zetatron is a small deuterium-tritium accelerator which uses a reflect discharge ion source and approximately 130 kV acceleration from a pulse transformer. The dominantly D(T,n) He reaction takes place in an occluder target consisting of a Scandium deuterotritide film deposited on a molybdenum slug. The instantaneous energy deposition rates at the target, the species present in the beam, and the beam profile determine target life and neutron output characteristics. The target temperatures are calculated for a single pulse and compared measurements of the thermal profile on a specifically-prepared, thin-target substrate. Target images are shown which illustrate the beam imaging process. The beam is found to consist of an intense spot 2-4 mm in diameter surrounded by a halo approximately the size of the target. The implications of such a beam profile are discussed. Computer codes are used to model the beam and to describe the parts of the tube that control the beam characteristics. (3 refs.)

65783 The EBIS-RFQ couple: a fully matched heavy ion 3rd pre-injector and Saturne. M.Olivier, J.Faure, J.L.Laclare, J.M.Lefebvre, G.Leleux, A.Ropert, A.Tkatchenko, M.Tkatchenko (Lab. Nat. Saturne, CENS, Gif sur Yvette, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1463-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

Since 1978, the 3 GeV Synchrotron Saturne has routinely operated with proton, deuteron, helium beams and, since 1981 with polarized protons and deuterons. Heavy ions are expected in the Summer of 1983 by using a new pre-injector presently under construction. As proposed by R.W. Hamm the marriage of an EBIS and an RFQ can be looked upon generally as a very good means of production of heavy ion beams at low energy because it combines high charges states, therefore low voltage on the terminal, and low velocity acceleration. After the RFQ, the beam is injected into Saturne through 20 MeV Alvarez linac. (29 refs.)

65784 Confinement of pulse-injected external ions in magnetostatic and electrostatic ion traps. H.A.Schuessler, Chun-Sing O (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1468-71 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

Numerical methods are used to evaluate the confinement properties of both a Penning ion trap and a purely electrostatic ion trap for pulsed ion injection from an external source. Hereby the optimum time intervals for switching on the storage fields are obtained for singly charged ions of mass 100 u and energies up to 100 eV, as an example. For the Penning trap only axial injection along the external magnetic field is feasible. In the case of the purely electrostatic trap both axial and radial-equatorial plane incidence directions are considered. It is shown that for both storage devices practically all ions in a pulse of one microsecond duration can be tapped for properly chosen time delays and injection parameters. (9 refs.)

65785 Compensation of aberrations in achromatic quadrupole doublets. F.W.Martin (Microscope Associates Inc., Dedham, MA, USA), R.Goloskie.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1472-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

An achromatic quadrupole lens contains an electric and a magnetic quadrupole lens operated at the proper field ratio. Using a doublet of achromatic lenses in which a quadrupole voltage may be applied to the magnetic poles of one of the lenses in order to rotate its principal section, the author has eliminated simultaneously what may be called three first order aberrations of a quadrupole doublet. These are chromatic aberration, rotational misorientation, and focus. By adding suitably chosen small potentials to the quadrupole excitation of an electric lens, 2nd order parasitic aberration may be compensated. Experimental procedure for compensation is described. The procedure appears capable of improvement, and further work is warranted. Currently a beam of 600 keV protons with a width of 0.6 micron is obtained. (8 refs.)

65786 Axially symmetric electrostatic and magnetic fields for ion beam focusing. J.C.Kelly (Dept. of Electrical & Computer Engng., Arizona State Univ., Tempe, AZ, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1476-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

The electric field between two oppositely charged concentric cylindrical conductors is proportional to $1/r$ where r is the radial distance from the axis of the pair of conductors. The magnetic field around a straight wire carrying a current is also proportional to $1/r$. Both these fields can act as ion or electron beam lenses for hollow tubular beams. Coaxial with the conductors. For the beam moving close to the inner conductor, r small, the fields are strong and powerful focusing is possible. Some of the characteristics of these new systems are described, recent applications mentioned, and future uses suggested including the generation of synchrotion radiation. (15 refs.)

65787 Theoretical considerations associated with the production of negative ions in sputter-type ion sources. G.D.Alton (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1480-90 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

Processes which are important to the optimum formation of negative ions by sputtering in the presence of an alkali metal are discussed. Negative ion generation probabilities calculated from several theoretical models including the tunneling, Norskov and Lundqvist (1979), 'freezing' approximation of Overbosch and Los (1981) as well as modified surface ionization theories (Alton et al., 1979) are compared with experimental observation. An analytical expression is introduced which reproduces with good accuracy observed maximum work function changes for electropositive adsorbates on metallic adsorbants. The expression is extremely useful for computing the value of the work function at its minimum which in turn can be used in the appropriate model for computing optimum negative ionization probabilities. (32 refs.)

65788 New developments in atomic beam polarized ion sources at ETH-Zurich. W.Gruebler, P.A.Schmelzbach (Lab. fur Kernphys., ETH, Zurich, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1491-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

For the production of negative ions, which are particularly interesting for tandem accelerators and for use in high energy machines by application of charge exchange and multiturn injection, either a double charge exchange in an alkali vapour or the direct ionization of the atoms by a neutral Cs beam is used. In the last few years substantial progress on the performance of the electron impact ionizer and the double charge exchanger has been made in the authors' laboratory. A proton or deuteron beam intensity of over 100 μA has been observed in the positive stage of the source. A polarized negative ion intensity of 6 μA was obtained after the charge exchange. After acceleration in the ETH EN-tandem accelerator 2 to 3 μA of polarized deuterons with 90% polarization could be focussed through a 3 mm diameter collimator on a target. This is the highest value ever reported for an accelerated beam. (15 refs.)

65789 Calculated and measured emittance of a sputter-type negative-ion source. J.H.Billen (Dept. of Nuclear Engng., Univ. of Wisconsin, Madison, WI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1495-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

A method for calculating the beam current and emittance of a negative ion beam from a sputter-type source is described. Calculations are compared to measured emittance. The dependence of the emittance on ion source parameters such as cathode shape, exit aperture diameter, and cathode voltage is discussed. (7 refs.)

65790 Application of multiply charged ions to small accelerators. M.Muller (Gesellschaft fur Schwerionenforschung mbH, Darmstadt, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1499-501 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

The Unilac injector ion source for multiply charged ions based on the work of Morozov (1957) and Pasyuk (1963) is described briefly. Beam performance and typical operating parameters are given with respect to recent modifications (1981). Technical limits of the present set-up are shown and a new ion source assembly is presented by which a better multipurpose ion beam application can be achieved. First test stand results of this so called 'compact-PIG-source' are discussed. (7 refs.)

65791 Experience with a double-compensating beam calorimeter. N.Jarmie, R.E.Brown, R.A.Hardekopf, R.Martinez (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1508-10 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

In an experiment to measure the D(t,α)n cross section at beam energies of 10 to 120 keV, the authors have developed a double-compensating beam calorimeter, based on a Swiss Design (Thomann and Benn, 1976) to measure the particle beam intensity. A Faraday cup is not useful because of considerable charge exchange in the target gas at such low beam energies. They calibrated the calorimeter both with 10- and 3-MeV protons (comparing with a Faraday-cup measurement of the beam flux) and with the heat generated in a precision resistor. Both methods agree and give a calibration accurate to ±0.08% over a range of 10 to 800 mW beam power. Beam powers as low as 5 mW may be used, but with less accuracy. The beam energy must be known in order to calculate the particle intensity. Some difficulties with and peculiarities of the device are discussed. (5 refs.)

65792 Dynamic control of accelerator systems utilizing microprocessor technology. H.F.Malone,Jr. (Radiation Dynamics Inc., Melville, NY, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1511-13 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The design and execution of an accelerator control system can be a complex task. Developing sophisticated control elements and associated dialogue usually leads one to strongly consider a top down design. Microprocessing technology recently developed, allows much more flexibility, expandability, performance, security, accuracy and most of all reliability, to control systems as compared to their analog counterparts. Microprocessors have provided industry with an inexpensive control vehicle. As one views these devices over time one sees prices dropping as capability increases, yielding lower cost per function. The author discusses general design considerations, terminal voltage and scan control, beam control, and parameter control functions. (3 refs.)

65793 An absolutely calibrated source of 6.13 MeV gamma-rays. H.Mach, D.W.O.Rogers (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1514-17 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
At the 340 keV resonance in the $^{19}F(p,\alpha\gamma)^{16}O$ reaction, after kinematic corrections, there is a 1:1 correspondence between the 55° yield of alpha particles feeding the 6.13 MeV state and the yield of 6.13 MeV photons observed at 55° to the proton beam. The 55° intensities of alpha particles feeding the various states in ^{16}O were found to be: $\alpha_{6.05}$: $\alpha_{6.13}$: $\alpha_{6.92}$: $\alpha_{7.12}$=≤0.14: 100: 0.08: 2.6 which implies the only non-negligible contaminant is a 7.12 MeV gamma-ray radiation with an intensity of 2.6%. After a number of small corrections, including those for photon attenuation in the target backing and air, the fluence of 6.13 meV gamma-rays can be determined absolutely with an uncertainty of ~1%. Excellent agreement was obtained in a comparison of the calculated and measured efficiencies of a 5″×4″ NaI detector. The calibration of Ge(Li) detectors required an aluminium coated target to avoid a Doppler tail on the 6.13 MeV photon peaks caused by ^{16}O nuclei recoiling from the surface of the CaF_2 target. (16 refs.)

65794 Bunching characteristics of a buncher using helical resonators. Chen Chia-erh, Guo Zhi-yu, Zhao Kui (Dept. of Tech. Phys., Peking Univ., Beijing, China). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1524-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A RF buncher consisting of two coupled helices tuned to 28.4 MHz was tested on the beam line of a 400 KV DC injector. Bunched waveforms versus RF power input were measured and analysed. With 8.4 W power input the proton beam was compressed to 1 ns (FWHM) bursts. The beam pulse splitted into double peaks at a higher power level depending on the initial energy dispersion. Both peak separation and the pulse height changed remarkably with increasing power input, and the overlapping of peaks in neighbouring cycles occurred alternately. By making use of phase diagram in time-energy space a simple formalism is presented for the analysis of the bunching characteristics. Results obtained are well consistent with the experiment. The effect of the quadrupole lens on bunched waveform was also observed and discussed. (9 refs.)

65795 Calibration of an analyzing magnet using a time-of-flight technique. W.N.Lennard, D.Phillips, R.Hill (Chalk River Nuclear Labs., Atomic Energy of Canada Ltd. Res. Co., Chalk River, Ontario, Canada). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1532-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The authors have calibrated the analyzing magnet (Danfysik 90° sector, double-focussing, 2 m radius) serving the CRNL 2 MV high voltage mass separator. The method depends on a measurement of the time-of-flight, and thus of the velocity, of magnetically analyzed ions of known mass and charge state. Results have been obtained for ions in the mass range 1-208 amu for fields 0.4-12.8 kG. (7 refs.)

65796 Preparation and characterization of heavy ion targets. H.L.Adair, E.H.Kobisk (Oak Ridge Nat. Lab., Oak Ridge, TN, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1555-62 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Many of the same target preparation techniques used to fabricate samples to be bombarded with light ions (protons, deuterons, $^4He^{++}$, etc.) in various nuclear research studies can be and are used in fabricating targets for heavy ion interaction research. However, the experimental data obtained in heavy ion studies are far more sensitive to variations in target parameters than those resulting from light ion interactions. Careful consideration of anticipated results of the research must be given in selecting preparative techniques that can yield the desired target characteristics. Proper interpretation of experimental results demands that the target used is extensively characterized. Effects of specific target parameters, e.g. thickness, nuclidic uniformity, impurity concentration and identification, are reviewed. Preparative and characterization techniques are critically examined in terms of their effects on experimental results and on target lifetime. (20 refs.)

65797 Preparation of the elemental form of enriched isotopic materials for target fabrication. J.M.Heagney, J.S.Heagney (MicroMatter Co., Eastsound, WA, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1563-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A review of reduction techniques employed to produce metal for the fabrication of isotopic targets used in nuclear physics is presented. The methods discussed take into account the small quantities of material available, as well as the chemical forms in which the separated isotopes are provided. For some materials, several alternative reduction techniques are given to allow for variations in available equipment and the final fabrication technique to be employed. Advantages and disadvantages with respect to yield and resultant metal purity are discussed. A table of pertinent data and recommendations is presented. (7 refs.)

65798 Preparation of nuclear accelerator targets by focused ion beam sputter deposition. H.Folger, J.Klemm, M.Muller (GSI, Darmstadt, Germany). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1568-72 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A duoplasmatron ion source with einzellens extraction was used to prepare focused beams of 10-30 kV of Ar ions with intensities of 1 mA. An em/m-analysis was performed to study the general behaviour of the source. The composition of the beam was investigated to trace and reduce contaminations from extraneous source materials. The Ar-ion beam was applied to sputter milligram-amounts of chemical elements and enriched isotopes of elements having high melting points, such as Zr, Mo, Ru, Ta, W, Ir, etc. The sputtered substances were collected in thicknesses varying from 0.01÷2.0 mg/cm^2 onto thin target backings of C, Ti, Cu, or Pb. Self-supported targets were obtained by dissolving backings chemically. Among others, targets of ^{182}W and ^{184}W with thicknesses from 0.19-0.65 mg/cm^2 were thus prepared. Sputtering yields were measured for a series of different target materials. The results are discussed in detail. The targets have been fabricated for various experiments involving high intensity heavy ion bombardments with energies of up to 15 MeV/u of ^{58}Ni, ^{208}Pb, and ^{238}U ions at the GSI UNILAC accelerator. (13 refs.)

65799 Availability of enriched isotopic material for accelerator targets. E.Newman (Operations Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1573-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The electromagnetic isotope enrichment facility at the Oak Ridge National Laboratory provides a broad spectrum of highly enriched stable isotopes to the worldwide scientific community. The continued timely availability of these materials is of vital importance in many areas of basic research and, in particular, as source material for the fabrication of accelerator targets. A brief description of the facility and its capabilities and limitations is presented. (no refs.)

65800 Preparation and characterization of tritium targets. D.W.Ramey, H.L.Adair (Oak Ridge Nat. Lab., Oak Ridge, TN, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1575-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The Isotope Research Materials Laboratory (IRML) of the Oak Ridge National Laboratory (ORNL) prepares tritium targets that are used to produce an intense beam of 14.5 MeV neutrons by the $^3H(^2H,n)^4He$ reaction. The intense beams of 14.5 MeV neutrons are used in programs involving cancer research, materials evaluation, and materials identification. The tritium targets required by researchers have ranged in size from 1-cm diam. to 50-cm diam. and have contained from 3.7×M10^4 MBq to 2.2×M10^8 MBq of tritium. Important parameters in the performance of tritium targets, when bombarded with deuterons, include target lifetime and neutron output. These parameters are heavily dependent on the host metal layer used to form the tritide compound and the gas-to-metal loading of the host material. Fabrication procedures used in preparing titanium tritide targets with subsequent gas-to-metal determinations are described. (4 refs.)

65801 Preparation of relatively clean carbon backings used in charged particle induced X-ray studies for X-rays below 4 keV. P.Kocur, J.L.Duggan, R.Mehta, J.Robbins, F.D.McDaniel (Dept. of Phys., North Texas State Univ., Denton, TX, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1580-2 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
In a recent series of studies of M-shell ionization induced by protons, alpha particles, and fluorine ions, an unmanageable background of low energy contaminant X-rays was observed. These K-shell X-rays were primarily from Ca, K, Cl, S, P, Si and Na. The energy range of these contaminants is from 3.691 to 1.041 keV. The M-shell X-rays being studied were for various elements from U (~3.5 keV) down to Eu (1.5 keV). In order to evaluate and reduce the problem, the contaminants for carbon foils from a number of different manufacturers and a wide variety of foil float-off procedures have been studied. Carbon foils have been produced using carbon rods from several different manufacturers. Techniques are described that are most appropriate to reduce the above contaminants to a reasonable level. These techniques should be useful in trace element analysis (PIXE) studies and fundamental ionization measurements for low X-ray energies. (11 refs.)

65802 Bremsstrahlung beams from high-power electron accelerators for use in radiation processing. S.M.Seltzer (Center for Radiation Res., NBS, Washington, DC, USA), J.P.Farrell, J.Silverman. *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1629-33 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The authors present the results of calculations of bremsstrahlung produced by a high power electron beam that is incident on a water cooled target. The calculation yields the efficiency of conversion of electron beam power to bremsstrahlung, the energy and angular distributions of the photons and the dose distribution of the resultant photon spectrum in a water phantom. The result is used to estimate radiation processing rates with bremsstrahlung photons and comparison is made with ^{60}Co radioisotope sources. (19 refs.)

65803 A compact neutron source for research and industrial applications. S.O.Schriber, M.A.Lone, B.G.Chidley, M.S.de Jong, S.A.Kushneriuk, W.N.Selander (Chalk River Nuclear Labs., Res. Co., Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1668-70 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The use of neutrons as a diagnostic tool has become more extensive in radiography, nondestructive analysis, bio-medical investigations and other general research studies. Although most diagnostic neutron work has been conducted at large nuclear research reactors, there is a need for compact and semi-portable neutron sources. Such a neutron source can be based on a low energy proton linac and suitable target. Design of a compact, 100% duty cycle, 2.5 MeV proton linac that delivers 10 mA to a thick ^7Li target is described. Calculated thermal neutron peak flux with an H_2O moderator is 2×10^{11} n/cm^2.s. The associated low gamma ray yield results in the availability of good neutron beam quality for radiography and other purposes. (9 refs.)

65804 Target systems for radioisotope production. G.Pinto, M.Straatmann, D.Schlyer, J.Currin, G.Hendry (Cyclotron Corp., Berkeley, CA, USA). *IEEE Trans. Nucl. Sci. (USA)*, vol.ns-30, no.2, p.1797-800 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A high power target to hold plated radioisotope target material for irradiation by an external particle beam, has been designed and tested. The paper describes the design and use of the target and its handling system, the External Target System with Isorabbit Transport. The target has been shown to dissipate up to 6.4 kW of beam power over an area of approximately 15 cm^2 while maintaining the target surface temperature below 160°C. The target design was optimized by using finite difference analysis of various cooling fin geometries; close correlation is observed between predicted and measured target heat transfer properties. Also described are high yield and high specific activity, short-lived, radioisotope production systems using protons as the bombarding particle. These include a system for ^{15}O, ^{13}N, and ^{11}C gas pro-

duction; a system for ^{13}N-ammonia production by proton irradiation of water; and a system for ^{18}F production by irradiation of ^{18}O gas. (10 refs.)

65805 New application of the superthermal Ultra-Cold Neutron source. I. The search for the neutron electric dipole moment. R.Golub (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
J. Phys. Lett. (France), vol.44, no.9, p.L321-6 (1 May 1983).
A superthermal Ultra-Cold Neutron source containing a dilute solution of polarized ^{3}He in ^{4}He can provide a method for carrying out the search for the neutron electric dipole moment which will not place any limits on the solid angle of the incoming neutrons and eliminate losses due to several causes. (24 refs.)

65806 Studies for adjustable energy proton beams from proton linear accelerators. Xu Jian-ming, Zhou Qing-yi, Wang Shu-hong (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.42-50 (Jan. 1983). In Chinese.
The principle of adjusting the proton energy from the linear accelerator with energy adjusting cavities is proposed. The requirements of energy adjusting cavities for tuning the proton energy efficiently and continually are studied. The energy range adjustable and the energy spread are calculated for the 35 MeV proton linac which is in the course of construction at the Institute of High Energy Physics, as an example. The energy spread as a function of electric parameters of energy adjusting cavities are also discussed. A specific and economical method to supply RF power to energy adjusting cavities is presented. (5 refs.)

65807 On relations among objects, images and beam waists for charged particle beams. Yu Qing-chang (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.51-6 (Jan. 1983). In Chinese.
The relations among objects, images and beam waists for charged particle beams are studied. On this basis, the relations between geometrical electron optics and beam transport theory are discussed. (3 refs.)

65808 Autoacceleration of a modulated beam. V.A.Boiko, A.I.Borodulin, R.M.Voronkov, G.V.Voskresenskii, V.S.Galkin, V.V.Dobrokhotov, V.N.Kurdyumov, G.L.Mamaev, K.G.Simonov.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1331-3 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2163-7 (Nov. 1982). [received: May 1983]
The interaction of a density-modulated electron beam with a passive resonator is considered. The modulation frequency is equal to the resonant frequency of the resonator, and the beam parameters at the resonator outlet are studied as functions of the percentage of modulation. Calculations reveal that the maximum attainable energy at the outlet is approximately three times greater than the energy of the particles at the inlet. Experimental measurements of the beam parameters are reported. At the outlet of the passive resonator a beam of accelerated electrons was produced with current $\sim$100 A and energy $>$500 keV; the current in the initial beam was 250 A and the electron energy was 250 keV. (5 refs.)

65809 General aspects on the use of high duty factor electron and photon beams in the intermediate energy region. J.M.Laget (CENS, Gif-sur-Yvette, France).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.4-24 vol.1
The author shows what one gains by working with high duty factor electron beams, but also why there is a need to increase the nominal energy of the present generation of intense electron accelerators. (29 refs.)

65810 General review of methods to achieve high duty-factor electron and photon beams. H.Herminghaus (Inst. fur Kernphys., Univ. Mainz, Mainz, Germany).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.36-46 vol.1
A systematic of the various kinds of possible high duty cycle (100% of close to) electron accelerators is derived and some characteristics are briefly discussed. A map of—to the author's opinion—most favorable accelerator types in the T-J-plane is given. The use of internal targets as a special feature of storage rings is briefly discussed in two examples. (no refs.)

65811 Condensed jet technology for internal targets. J.Gspann (Inst. fur Kernverfahrenstech., Univ. und des Kernforschungszentrums Karlsruhe, Karlsruhe, Germany).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.85-103 vol.1
Partly condensed jets of gas expanding through nozzles are finding rapidly increasing interest for internal targets in accelerator or storage rings. In most cases, the jets are used as sources for what has been called 'condensed molecular beams'—or'cluster beams'. Only the core of the jet reaches the high or ultra-high vacuum of the ring via differential pumping stages where practically all the uncondensed residual gas is pumped off. The microparticles of condensed matter, or clusters of atoms or molecules, which make up the final target beam, have very little thermal velocity spread, hence, do not collide with each other, i.e. they are moving under molecular flow conditions. (20 refs.)

65812 Storage and acceleration of polarized electrons. D.Husmann (Phys. Inst., Univ. Bonn, Bonn, Germany).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.116-25 vol.1
A review of theoretical and experimental work on storage and acceleration of polarized electrons is given. The main topic concerns resonance depolarization, but also Sokolov-Ternov polarization and external sources for polarized electron beams are covered. (37 refs.)

65813 Internal targets at Bates. C.P.Sargent (Lab. for Nuclear Sci., MIT, Cambridge, MA, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.126-8 vol.1
Until the present time the Bates Linear Accelerator Laboratory has been a single-apparatus facility. Almost all of the experimental programs have used the high-resolution energy-loss spectrometer. There is now the new South Hall, with three new magnetic spectrometers and an opening-angle π^0 spectrometer undergoing final assembly and test. The accelerator energy has been increased to 725 MeV by recirculation. A polarized source is under construction. Within two or three years it is expected that increased RF power capability will increase energy to about 1 GeV, and that there will be beam sharing capability between the South Hall and the energy-loss spectrometer. The top priority for future development is to increase the duty-factor of the experimental beams, approaching 100% duty, as soon as possible. It might be possible by the end of 1987, and a proposal is now in preparation. The chosen method is to provide a pulse-stretcher ring. The ring will have a circumference of 300 meters, bend radius of 9 meters, with up to 9 turns of injection possible in order to insure at least 50 mA output current. Resonance extraction will be used to provide external beam with design goal 2×10^{-4} in momentum resolution and 30 πmm-mrad ($\beta\gamma=1$) normalized emittance. (no refs.)

65814 Possibilities for internal tagging in the energy region 100-500 MeV at the accelerator system MAX. J.-O.Adler, L.-J.Lindgren, B.Schroder (Dept. of Phys., Univ. of Lund, Lund, Sweden).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.129-36 vol.1
In view of the great interest in nuclear physics studies with electromagnetically interacting probes and that few high duty-factor electron acclerators exists, the authors investigate the possibilities for such studies in the intermediate energy region at MAX. This accelerator system consists of a 100 MeV racetrack microtron to be used as an injector to a multipurpose ring. In the stretcher mode the ring will provide a high duty-factor external beam. In the storage mode the energy may be increased to around 550 MeV. It is not possible to extract the beam above 100 MeV. The authors investigate internal tagging similar to the method used at the 500 MeV synchrotron at the University of Bonn. (7 refs.)

65815 Internal target experiments at an electron storage ring. S.G.Popov (Inst. of Nuclear Phys., Novosibirsk, USSR).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.150-72 vol.2
The author discusses the idea of locating the target directly in the track of the cyclic device-storage ring. (20 refs.)

65816 Compton scattering of laser light; techniques and results. G.Matone (Lab. Nazionali di Frascati, INFN, Frascati, Italy).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.173-95 vol.2
The author describes how to achieve backward Compton scattering of an intense polarized laser beam by high energy electrons to produce useful yields of nearly monoenergetic and polarized photons. (20 refs.)

65817 The Brookhaven medium energy gamma ray project. A.M.Sandorfi, M.J.LeVine, C.E.Thorn (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA), G.Giordano, G.Matone.
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.196-203 vol.2
Within the next year the authors hope to begin the construction of a facility that would provide intense beams of monochromatic and polarized photons with energies in the range of several hundreds of MeV. These γ rays will be produced by Compton backscattering laser light from the electrons circulating in the 2.5-3.0 GeV X-ray storage ring of the National Synchrotron Light Source (NSLS) at Brookhaven National Laboratory. The authors summarize the essential aspects and phases of development of the BNL facility. (1 ref.)

5th High Energy Spin Symposium .... See Entry 64572

Workshop on SPS Fixed-Target Physics in the Years 1984-1989 (CERN-83-02) .... See Entry 64594

A horizontal dilution cryostat for polarized targets used in a high intensity photon beam .... See Entry 64909

Generation of t^{-2} voltage pulses for ion analysers .... See Entry 64993

Stable atomic hydrogen possible application in intense polarized sources .... See Entry 64994

Atomic hydrogen source with direct helium cooling .... See Entry 64995

Proton polarimeters at high energy .... See Entry 64996

Electromagnetic interference in high energy polarization .... See Entry 64997

Radio frequency characteristics of traveling wave accelerating sections calculated using a model resonator .... See Entry 65713

An accelerating section with a constant acceleration rate .... See Entry 65714

Improvement of the energy spectrum in standing wave accelerators by delaying injection .... See Entry 65715

Elimination of resonances by Siberian snakes .... See Entry 65716

Polarization at LEP .... See Entry 65720

Spin matching for polarized protons .... See Entry 65722

Generalized Froissart-Stora formula .... See Entry 65723

JSW's BABY CYCLOTRON .... See Entry 65729

Magnetic forces on the coils of the Superconducting Cyclotron at the University of Milan .... See Entry 65731

Experience with a 150 MeV pulse stretcher ring SSTR .... See Entry 65734

Storage rings with internal targets: design considerations .... See Entry 65736

A spectrometer coupled to an electron storage ring for tagging laser backscattered gamma rays .... See Entry 65822

Interaction of a helical nonsymmetric wave with a fast cyclotron wave in an electron beam .... See Entry 66191

Spectroscopic Doppler-free methods for measuring the electric and magnetic fiels in magnetically insulated ion diodes .... See Entry 66758

Cyclotron production of no-carrier-added medical radionuclides .... See Entry 69022

Small accelerators for borehole application .... See Entry 69373

29.30 RADIATION SPECTROMETERS AND SPECTROSCOPIC TECHNIQUES

65818 Features and performance of a gravity spectrometer for ultracold neutrons. A.Steyerl, B.Gmal, K.-A.Steinhauser, N.Achiwa (Fakultat fur Phys., Tech. Univ. Munchen, Garching, Germany), D.Richter.
Z. Phys. B (Germany), vol.50, no.4, p.281-8 (1983).
Reports on a novel ultrahigh-resolution neutron spectrometer utilizing the reach of the flight parabola of very slow neutrons in the Earth's gravitational field for precise energy definition. A full width at half maximum of (17.0 ± 0.6) neV was measured for elastic scattering from graphite. The authors were able to detect a line broadening by (6.6 ± 3.2) neV in quasi-elastic

scattering from a polymer in solution at a momentum transfer of 0.027 $Å^{-1}$ ħ. (30 refs.)

65819 Performance of a high efficiency position sensitive 30° parallel plate electron spectrometer. J.K.Swenson, D.Brandt (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1548-51 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A position sensitive parallel plate analyser (PSPPA) for the angle resolved study of electrons produced in ion-atom collisions has recently been built and tested. This new spectrograph consists of a 30° parallel plate analyser (PPA) equipped with a Chevron microchannel plate assembly with resistive anode encoding for one dimensional position analysis of electrons incident on the second order focal plane. The PSPPA has an electron detection efficiency of over 100 times that of conventional PPAs. (8 refs.)

65820 (e,e′X) experiments at NIKHEF-K. P.K.A.de Witt Huberts, L.Lapikas (NIKHEF-K, Amsterdam, Netherlands).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.60-72 vol.1
The present status of the instrumentation for (e,e′X) coincidence experiments and photopion production is reviewed. With the availability of high resolution in missing energy (<200 keV) and subnanosecond coincidence timing with two magnetic spectrometers a new generation of proton knockout experiments will be feasible. A series of approved experiments now underway is discussed. The authors show some first results and discuss future developments in experimentation. (14 refs.)

65821 Wide angle spectrometers for intermediate energy electron accelerators. P.Leconte (CENS, Gif-sur-Yvette, France).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.104-14 vol.1
Convinced by the advantage of the electromagnetic probe as a tool in nuclear physics, many people are now trying to develop new high energy electron accelerators with a main emphasis on very high duty cycle. Such efforts must be matched by equivalent improvements in detection efficiency. Increases in solid angle and momentum bite of spectrometers have therefore been discussed in great detail during recent workshops at Mainz and Argonne. The author shows that improvements of the detector acceptances (in solid angle and momentum bite) is as important as increased duty cycle for coincidence experiments. He points out also that they open the way to new possibilities for experiments: out-of-plane experiments and multiple coincidences, which are out of the reach of present facilities. (10 refs.)

65822 A spectrometer coupled to an electron storage ring for tagging laser backscattered gamma rays. C.E.Thorn, M.J.LeVine, A.M.Sandorfi (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.204-8 vol.2
A spectrometer has been designed to momentum analyze electrons, from the 2.5-3.0 GeV X-ray storage ring of the National Synchrotron Light Source at Brookhaven National Laboratory that have lost energy from the production of high energy γ-rays by Compton scattering of laser light. The electrons detected in the focal plane will provide a 'tag' for the backscattered γ-rays, determining their energy (to 2-3 MeV), and timing. This design utilizes the fact that, due to kinematics, the Compton scattered electrons have a transverse phase space negligibly different from that of the stored beam. It is constrained by the requirement of not altering any of the existing elements of the storage ring. In particular, no structures or fields interfere with the large aperture of the storage ring that is required for loading the ring. (4 refs.)

65823 A π^0 spectrometer for photopion production studies. M.J.LeVine, A.M.Sandorfi, C.E.Thorn (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.256-8 vol.2
One of the first experimental programs to be carried out with the BNL gamma-ray beam will be a study of (γ, π^0). The authors present a discussion of existing π^0 spectrometers and two new designs which, for the π^0 energy range of interest for this program, are superior to existing designs. (4 refs.)

65824 A charged-pion spectrometer for the BNL gamma ray beam facility. M.J.LeVine, C.E.Thorn, A.M.Sandorfi (Phys. Dept., Brookhaven Nat. Lab., Upton, NY, USA).
Workshop on the Use of Electron Rings for Nuclear Physics Research in the Intermediate Energy Region, Lund, Sweden, 5-7 Oct. 1982 (Lund, Sweden: Univ. Lund 1982), p.259-61 vol.2
The (γ,$\pi^{\pm}$) studies planned for the BNL gamma-ray beam facility necessitate the detection of charged pions in the energy range $25<T_\pi<150$ MeV with a modest resolving power to match the photon beam energy resolution (27 MeV). The solid angle must be as large as possible, and the total path length must be as short as possible to minimize the losses due to pion decay. (The mean lifetime corresponds to $L=4.87$ m for $T_\pi=25$ MeV). Finally, a means must be provided to reject pion decay products reaching the focal plane. A design for such a charged-pion spectrometer is presented. This design utilizes existing large aperture magnetic elements, and provides a momentum resolution of 0.68% at a solid angle of 50 msr, over a momentum range of 10%. (no refs.)

Generation of t^{-2} voltage pulses for ion analysers ....See Entry 64993
Calibration of an analyzing magnet using a time-of-flight technique ....See Entry 65795
Properties of intrinsic germanium detectors at low energies by escape peak spectroscopy ....See Entry 65832
Energy dependent instrumental delays ....See Entry 65841
High efficiency spectrographs for the EUV and soft X-rays ....See Entry 69502

29.40 RADIATION DETECTORS

(for mass spectrometers, see 07.75)

65825 The use of Ge detectors for precision positron-endpoint measurements of short lived nuclei. F.T.Avignone,III. (Univ. of South Carolina, Columbia, SC, USA), D.M.Moltz, K.S.Toth, B.D.Kern, H.Noma.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1136-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A brief review of the development and application of techniques for measuring positron endpoint energies using intrinsic Ge detectors is given. The calculation of detector response functions using Monte Carlo methods is discussed. Multiple scattering, bremsstrahlung, photoelectron escape and interference from annihilation radiations are considered. The techniques were tested using well known endpoints of the decays of ^{27}Si, ^{58}Cu and ^{64}Ga. *Q*-values were determined for mass-separated samples of ^{76,77}Rb and ^{77}Kr produced in heavy ion reactions. (17 refs.)

65826 Use of bremsstrahlung in the measurement of the efficiency of solid state detectors below 5 keV. C.Quarles, L.Estep (Dept. of Phys., Texas Christian Univ., Fort Worth, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1518-20 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Atomic-field bremsstrahlung produced by the bombardment of atoms by an electron beam of 5-10 keV energy provides a continuous X-ray source which is suitable for the measurement of the relative efficiency of solid state detectors in the energy region below 5 keV. The relative efficiency as a function of photon energy can be obtained by normalizing the observed spectrum to the theoretical bremsstrahlung cross section. The authors present an example of this technique using a thin film target and a gas beam target to illustrate some of the problems and to demonstrate the potential of this technique. (9 refs.)

65827 Bismuth germanate as a high-energy gamma-ray detector. S.A.Wender (Los Alamos Nat. Lab., Los Alamos, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1539-42 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Recently bismuth germanate ($Bi_4Ge_3O_{12}$), or BGO, scintillators have been developed with many properties that may make them an attractive alternative toNaI in many applications. The requirements of the detector system for the detection of gamma rays following high-energy neutron capture are that it have good energy and time resolution, high efficiency, and low sensitivity to neutron backgrounds. The author has constructed a detector system consisting of five 7.6-cm-long by 7.6-cm-diam-BGO scintillators spanning an angular range from 140 to 45 degrees in the reaction plane. Results of the measurements of the energy resolution, the absolute efficiency and the time resolution are presented. (11 refs.)

65828 The use of high purity germanium for the detection of 20 to 200 MeV light ions. D.L.Friesel (Indiana Univ. Cyclotron Facility, Bloomington, IN, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1543-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
While lithium-drifted germanium detectors have become an accepted tool for high resolution gamma ray spectroscopy, they were also shown to be excellent charged-particle detectors as well. Their use for this purpose was limited, however, by the practical complexities of their handling and storage at liquid-nitrogen temperature, and consequent incompatibility with typical nuclear research scattering chambers. Many of these difficulties were eliminated by the development of the high-purity germanium detector. A variable geometry detector telescope system using these high-purity planar germanium detectors has been developed and used at intermediate energies. A detailed description of the telescope system is presented, along with some practical experience of their use as light ion detectors. The effects of radiation damage and the radiation damage annealing procedures on detector properties and performance are emphasized. (15 refs.)

65829 Non-coincidence type background compensation for Geiger-Muller counters. R.C.Bhattacharya, P.K.Ghosh (Phys. Res. Wing, Projects & Dev. India Ltd., Sindri, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.1005-6 (Dec. 1982). [received: April 1983]
Background compensation in a GM counter is achieved by cancelling one count for every pulse in a second GM tube receiving background only. The method suits portable instrumentation. (no refs.)

65830 A new kind of particle detector using petrolic gas. Du Yuan-tsai, Li Jian-ping, Liu Shu-dong, Tang E-sheng (Inst. of High Energy Phys., Acad. Sinica, Peking, China), Li Xiang-cheng.
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.126-8 (Jan. 1983). In Chinese.
The authors have developed a new kind of particle detector using petrolic gas, which is based on the SQS (self-quenching streamer) discharge mode. It is possible to save a lot of money if this kind of detector will be used as some elements of high-energy spectrometers at electron-positron colliders or other kinds of high-energy accelerators. It is possible to use this kind of detector in low-energy nuclear technology, health physics and environment protection regions, too. (5 refs.)

65831 Absorption of averaged hadron cascades in an ionization calorimeter. V.P.Pavlyuchenko.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.12-16 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.16-20 (1982).
The averaged cascade curves are analyzed phenomenologically. It is shown that their absorption depends not only on the coefficient χ of the irreversible energy emission from the cascade hadron component, but also on its relative rate of change χ'/χ. (3 refs.)

65832 Properties of intrinsic germanium detectors at low energies by escape peak spectroscopy. B.Rosner, D.W.Mingay (Atomic Energy Board, Pretoria, S Africa).
X-ray Spectrom. (GB), vol.12, no.2, p.82-6 (April 1983).
The study of the energy resolution and linearity of germanium X-ray detectors at very low energies is difficult due to the degradation of the spectral line shapes resulting from incomplete charge collection in the detector's surface dead layer. The use of low-energy, K escape peaks obviates this difficulty as they are observed at depths characteristic of their full-energy parent photons. Measurements have been performed using particle-induced X-ray emission analysis of targets having characteristic K and L X-ray energies just above the Ge K-edge. The escape peaks retain pure Gaussian shapes down to the noise level of the detector and open up the possibility of a selective field of high-resolution escape-peak spectroscopy. (20 refs.)

65833 NRESP4 and NEFF4. Monte Carlo codes for the calculation of neutron response functions and detection efficiencies for NE 213 scintillation detectors. G.Dietze, H.Klein.
Report PTB-ND-22, Phys.-Tech. Bundesanstalt, Braunschweig, Germany (Oct. 1982), 45 pp.
Describes two Monte Carlo codes, NRESP4 and NEFF4, for calculating detector response functions and detection efficiencies of NE 213 scintillation detectors by incidence of fast neutrons in the energy range from 0.02 MeV to 20 MeV. The codes include neutron scattering effects in the Al detector housing and in a light pipe. An extensive set of cross section and differential

cross section data has been included. Various light output functions for protons may be used. (21 refs.)

65834 Light production from Gd_2O_2S intensifying screens. L.Bacarini, A.Di Lelio, R.Giacomich, F.Tomasini.
Report INFN/TC-83/1, Ist. Naz. Fis. Nucl., Trieste, Italy (15 Jan. 1983), 23 pp.
The physical parameters of absorption and the light conversion efficiency have been measured by means of a NaI spectrometer and the SPC technique. This allows the authors to calculate the number of light photons emitted per incident X-ray having different energies (from 10 to 120 keV), and therefore the total efficiency curves ('Absolute Speed Curve' ASC). The phenomenon of ionisation energy loss due to fluorescent X-rays production for incident X-rays having an energy above the K-edge of the Gd, was evaluated as well as the particular behaviour of the T_{16B} whose high thickness makes the phenomena of internal light and fluorescent X-ray absorption important. (8 refs.)

65835 Reconstruction of data in low-mass magnetostrictive chambers. H.M.Daley.
Report RL-82-086, Rutherford Appleton Lab., Chilton, Oxon., England (Jan. 1983), 16 pp.
This report describes the reconstruction of spark positions in a set of low-mass spark chambers with remote magnetostrictive readout, used by a Rutherford Laboratory experiment. (4 refs.)

65836 Track reconstruction in an inhomogeneous magnetic field for a polarised target experiment. R.Maybury, H.M.Daley.
Report RL-82-087, Rutherford Appleton Lab., Chilton, Oxon., England (Feb. 1983), 41 pp.
This report describes a program which was developed to reconstruct particle tracks through a number of detectors in the fringe field of a polarised target magnet used in a Rutherford Laboratory experiment. The method uses weighted line fits to follow tracks distorted by the magnetic field. (5 refs.)

Liquid ionization chamber for absorbed dose determinations in photon and electron beams .... See Entry 65683

The ITEP polarized target installation for the study of interactions between hadrons and polarized protons at intermediate energies .... See Entry 65756

An absolutely calibrated source of 6.13 MeV gamma-rays .... See Entry 65793

Performance of a high efficiency position sensitive 30° parallel plate electron spectrometer .... See Entry 65819

(e,e'X) experiments at NIKHEF-K .... See Entry 65820

Design and test of a Cerenkov detector system for studying parity violation effects in electron-nucleon scattering .... See Entry 65837

Energy dependent instrumental delays .... See Entry 65841

29.70 RADIATION MEASUREMENT, DETECTION AND COUNTING

(see also 29.30 Radiation spectrometers and spectroscopy, 29.40 Radiation detectors; for dosimetry, see 87.60M)

65837 Design and test of a Cerenkov detector system for studying parity violation effects in electron-nucleon scattering. J.Ahrens (Max-Planck-Inst. fur Chem., Mainz, Germany), K.-J.Dietz, H.-J.Gessinger, H.-J.Kluge, F.Neugebauer, E.-W.Otten, H.-H.Andresen, W.Heil, R.Neuhausen, R.Thornagel, B.Wagner.
AIP Conf. Proc. (USA), no.95, p.159-6 (1982). [received: April 1983] (5th High Energy Spin Symposium, Westhampton Beach, NY, USA, Sept. 1982).
Describes an experimental set up for the measurement of the parity violation by weak neutral currents in the quasi-elastic scattering of 300 MeV longitudinally polarized electrons. It consists of the polarized electron source, the 300 MeV linear accelerator at Mainz, several monitors for the detection of the properties of the electron beam (intensity, energy, position, polarization), a Be target (15 mm thick), and the gas Cerenkov counter. A careful analysis of the performance of the detector system (signal to background ratio, apparative asymmetry) has been performed with unpolarized electrons. Some results are presented. These tests indicate that the neutral current effect can be measured within 15 h to confidence level of 99.5%. (no refs.)

65838 Statistical fluctuation problem in pulsed radiation diagnostics. Lu Min (Inst. of Atomic Energy, Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.216-24 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
When the waveform of a radiation pulse is measured, a large number of a radiation particles interact with the detector simultaneously. The output current waveform is proportional to the waveform of the radiation pulse. The statistical fluctuation phenomenon will appear when the radiation source is relatively weak or the sensitivity of the detector is low. The fluctuation phenomena are considered and mathematical expressions for fluctuations are given. The author also discussed the uncertainty due to statistical fluctuation of various pulse parameters measured, such as amplitude, width, time interval and other special parameters. (2 refs.)

65839 Characteristics of a detector of tagged neutrinos. I.P.Nedyalkov (Inst. of Nuclear Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.35, no.12, p.1651-4 (1982).
Accuracy of measurement, detection time and other characteristics of a detector of tagged neutrinos were studied. The energy of the neutrinos was assumed to be higher than a few TeV. The investigation was made within the framework of the Weinberg-Salam-Glashow theory. (35 refs.)

65840 Experiments with sub-nanosecond tandem beam pulses. S.L.Tabor, G.Neuschaefer (Dept. of Phys., Florida State Univ., Tallahassee, FL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1504-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The beam pulsing system, which was installed on the Florida State University FN tandem accelerator to prepare the beam for injection into the superconducting linac booster, has been used for a variety of experiments. The system has been used to study the $^{11}B(d,n)^{12}C$ reaction at 12 MeV. Neutrons were detected in a plastic scintillator viewed by two photomultiplier tubes connected to a mean timer circuit. The overall timing resolution of about 500 psec provides adequate time-of-flight resolution at a distance of 2 m. Of particular interest in this reaction are a triplet of states in ^{12}C between 18 and 21 MeV which have recently been studied in several intermediate-energy experiments. Another experiment has used the pulsed beam in conjunction with the mid-column stripper to search for nanosecond isomers and yrast traps with the $^{28}Si+^{56}Fe$ reaction at 103 MeV. (9 refs.)

65841 Energy dependent instrumental delays. M.A.Raoof (Dept. of Phys., King Saud Univ., Riyadh, Saudia Arabia), S.A.Raoof.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1552-H (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Energy dependent delays in the case of a coincidence beta spectrometer and the detecting system have been studied. Both the ends of the spectrometer were coupled with scintillation counters comprising of plastic scintillator pilot U and sub-nanosecond rise time photomultiplier RCA C70045D. Timing pulses were processed by electronic units, which included Ortec, TFA, CFPHD and Biased TPHC. Conversion electrons from Ir-192 were utilized for these studies. In one channel of the spectrometer fixed energy 468 KeV K-conversion electrons were focused, while different energy electrons in the range of 468 to 670 KeV were focused in the other channel. Moments of the resulting delayed time spectra were calculated about the mean of peak position as a function of difference in energy of the radiations in the two channels. A polynomial fitting to the experimental points was used. The results show a nonlinear character even over an energy range of 200 KeV. (8 refs.)

65842 Measurement of the number of radioactive atoms and the half-life. IV. Applications and accuracy of N_0. Feng Xi-zhang, Zhao Zhen-lan, Guo Ying-huan, Lo Shi-hua, yang Rui-Ying, Huang Zhong-xiang, Jiang yong (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.114-17 (Jan. 1983). In Chinese.
The applications of N_0, the number of atoms of a certain radioactive isotope in a target at a given time t_0 (usually the end of a bombardment by incident particles) in the measurement of the reaction cross section or the beam intensity or in the activation analysis are discussed and the accuracy of N_0 (also the cross section) is analyzed. (no refs.)

65843 Detection of neutrino at large distances from the accelerator. V.A.Tsarev, V.A.Chechin.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.17-21 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva,* no.8, p.21-5 (1982).
Simple expessions are obtained for the count rate of neutrino events in detectors with external and internal targets positioned at large distances from the accelerator. (2 refs.)

Direct verification of the quantum spin-state superposition law .... See Entry 64719

Polarized proton and antiproton beams and experiments at the Tevatron .... See Entry 65743

Experience with a double-compensating beam calorimeter .... See Entry 65791

An absolutely calibrated source of 6.13 MeV gamma-rays .... See Entry 65793

The use of Ge detectors for precision positron-endpoint measurements of short lived nuclei .... See Entry 65825

Use of bremsstrahlung in the measurement of the efficiency of solid state detectors below 5 keV .... See Entry 65826

Bismuth germanate as a high-energy gamma-ray detector .... See Entry 65827

Potential information and stopping power from channeling in diamond .... See Entry 67070

Charge dependence of slow-ion energy losses in transmission experiments .... See Entry 67071

Range distributions of low energy ions in silver and copper .... See Entry 67072

Stopping power for fast nitrogen and oxygen diclusters in carbon .... See Entry 67073

Precision measurements of rare radioisotopes with a tandem Van de Graaff accelerator .... See Entry 69372

29.75 POLARIZATION ANALYSIS

5th High Energy Spin Symposium .... See Entry 64572

Stable atomic hydrogen possible application in intense polarized sources .... See Entry 64994

Atomic hydrogen source with direct helium cooling .... See Entry 64995

Proton polarimeters at high energy .... See Entry 64996

Electromagnetic interference in high energy polarization .... See Entry 64997

A double target cell cryostat with quick interchange of target cells .... See Entry 65752

Ammonium borohydride—a novel, hydrogen-rich material for polarized targets .... See Entry 65753

Irradiated NH_3 and ND_2—two new target materials for polarized targets .... See Entry 65754

Present status of spin frozen deuteron target at KEK .... See Entry 65755

The ITEP polarized target installation for the study of interactions between hadrons and polarized protons at intermediate energies .... See Entry 65756

Polarisation properties of irradiated ammonia (NH_3 and ND_3) at 1K and 25 kG .... See Entry 65757

Dynamic nuclear polarization of irradiated targets .... See Entry 65758

Workshop report on polarized proton ion sources .... See Entry 65759

Spin-polarized hydrogen: new possibilities for polarized sources and targets .... See Entry 65760

Solid state polarized electron sources .... See Entry 65761

Polarized electron source for parity experiment at Bates .... See Entry 65762

A source of polarized electrons for a neutral current parity experiment .... See Entry 65763

Polarized photons for a measurement of parity violation in deuterium .... See Entry 65764

A spin flipper for thermal atomic beams .... See Entry 65765

Progress on producing polarized negative hydrogen ions by the ETHZ polarized ion source using the atomic beam method .... See Entry 65766

Status of the AGS polarized H^- source .... See Entry 65767

Recent development of optical pumping type polarized ion source at KEK .... See Entry 65768

Improved Cs^0 source for the production of polarized H^- ions .... See Entry 65769

29.80 NUCLEAR INFORMATION PROCESSING

65844 Data communications in high energy physics. M.G.N.Hine (CERN, Geneva, Switzerland).
Europhys. News (Switzerland), vol.14, no.2, p.4-6 (Feb. 1983).
Outlines the development of data networks for use in high energy physics research where many universities may collaborate on one project. (1 ref.)

65845 Information system for generation availability - Executive summary. R.W.Keller.
Report EPRI-NP-2875, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 28 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
This report presents a summary of EPRI-sponsored research into the requirements, applications, and design of an information system for generation availability (ISGA). A review of the program's accomplishments is provided, and a guide is included to the available material, the majority of which is in a form that enables direct adaptation and application by individual utilities. EPRI funding and industry support for the ISGA, initiated in 1976, were terminated in 1982.

65846 Organization and structure of an EPRI DATATRAN data bank. G.A.Cordes, G.A.Mortensen.
Report EPRI-NP-2873, Electr. Power Res. Inst., Palo Alto, CA, USA (Feb. 1983), 64 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
Details of the EPRI DATATRAN executive computer code and data base management system are provided. Composition of the data base is described, and the organization of the data bank and the structure of the data in the data bases are presented along with a description of the DATATRAN module SELECTB, which is used to sort the data.

NRESP4 and NEFF4. Monte Carlo codes for the calculation of neutron response functions and detection efficiencies for NE 213 scintillation detectors ....See Entry 65833

30.00 ATOMIC AND MOLECULAR PHYSICS

(for physical chemistry, see 82.)

31.00 THEORY OF ATOMS AND MOLECULES

(see also 71. Electron states in condensed matter)

31.10 GENERAL THEORY OF STRUCTURE, TRANSITIONS AND CHEMICAL BINDING

65847 Topological analysis of the current density field in molecules. J.A.N.F.Gomes (Dept. de Quimica, Faculdade de Ciencias, Porto, Portugal).
THEOCHEM (Netherlands), vol.10, p.111-27 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
A global qualitative theory of the current density has been very recently introduced by the author. These topological studies are reviewed and special attention is given to the shape of the separatrices which encase both toroidal and axial vortices. (20 refs.)

65848 Atomic physics of negative ions: a report on the US-Mexico joint workshop. T.J.Morgan (Phys. Dept., Wesleyan Univ., Middletown, CT, USA).
Comments At. & Mol. Phys. (GB), vol.12, no.5-6, p.319-26 (1983).
A workshop on the atomic physics of negative ions was held recently in Galindo, Mexico. Forty physicists from six countries participated, and twenty-six invited presentations reviewed the field. This report summarizes the motivation for such a workshop and outlines some of the highlights. (6 refs.)

31.15 GENERAL MATHEMATICAL AND COMPUTATIONAL DEVELOPMENTS

65849 Energy variation and elementary Jacobi rotations. R.Carbo, L.L.Domingo, J.Peris (Dept. de Quimica Organica, Inst. Quimic de Sarria, Barcelona, Spain), J.Novoa.
THEOCHEM (Netherlands), vol.10, p.15-33 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
A general exploration of elementary Jacobi unitary transformations is carried out in order to accomplish, within the LCAO-MO scheme, the minimum search of the electronic energy expression for any system and to construct an optimal wavefunction. It has been found that when comparing the Jacobi procedure with the classical SCF schemes, based on coupling operators, some facts portray the unitary transformation technique as an excellent candidate to compute energy and an alternative way to take into account SCF procedures. (13 refs.)

65850 Topological elements of the magnetically induced orbital current densities. J.A.N.F.Gomes (Dept. de Quimica, Faculdade de Ciencias, Porto, Portugal).
J. Chem. Phys. (USA), vol.78, no.7, p.4585-91 (1 April 1983).
A detailed topological analysis is given, both for the standard orbital current density and for the complete orbital current density. The concepts developed here provide a very useful instrument for the description of the vector field of the magnetically induced currents and should be very helpful for the understanding of the contributions that different regions of a molecule give to its magnetic properties. The ingredients for this topological analysis are (1) the symmetry properties of the electronic Hamiltonian in the presence of the magnetic field and (2) the nature of certain singular points. Two categories of singular points are considered: (i) Nodal vortices which have associated a circulation around a nodal line and may be of the axial or toroidal types as previously considered by Hirschfelder (1980); (ii) Stagnation points where the current vanishes without the vanishing of the charge density. There is a considerable variety of stagnation points and, under certain conditions basically on the magnetic field, they may have associated a vortical circulation of currents in their immediate neighborhood. For the complete orbital current (defined as the sum of the standard orbital current and the orbital exchange current), the stagnation points may occur isolated or they may form stagnation lines. When the regime of the circulation around this line changes between vortical and normal, a new type of stagnation point, the transition point, is found. (17 refs.)

65851 An improved approximate energy formula for molecules in terms of corrected free atom energies. E.A.Castro, F.M.Fernandez (Seccion Quimica Teorica, Inifta, La Plata, Argentina).
J. Chem. Phys. (USA), vol.78, no.7, p.4782-3 (1 April 1983). (10 refs.)

65852 On the localization of the resonance state wave function in the complex coordinate method. K.Deguchi, Y.Kato, K.Nishikawa, S.Aono (Dept. of Chem., Kanazawa Univ., Kanazawa, Japan).
J. Chem. Phys. (USA), vol.78, no.8, p.5272-3 (15 April 1983).
The complex coordinate method (CCM) developed by Aguilar, et al. (1971) and Simon (1972) is now being recognized as a useful method directly capable of estimating resonance positions and widths. An important feature of the CCM is that resonance states are obtainable in terms of only square integrable basis functions, as are bound states. Hence, any explicit asymptotic boundary condition which make calculations of resonance states very cumbersome is not required in the CCM. The CCM has been so far applied to many electronic and nuclear resonance problems. It seems, however, that many attempts have concentrated on calculations of resonance state energies while behaviours of the corresponding wave functions have been little investigated. The authors investigate the localization of the resonance state wave functions in the CCM within the framework of a simple two-state model. In order to look at the wave function behaviors in the vicinity of the inner region, they adopt here the stabilization method. (6 refs.)

65853 The valence-bond self-consistent field method (VB-SCF): theory and test calculations. J.H.van Lenthe, G.G.Balint-Kurti (School of Chem., Bristol Univ., Bristol, England).
J. Chem. Phys. (USA), vol.78, no.9, p.5699-713 (1 May 1983).
A new and very general form of valence-bond theory is described. In this theory the molecular wave function is written as any desired linear combination of valence-bond structures, and the nonorthogonal orbitals used in the construction of the valence-bond structures are allowed to distort to their optimal shapes. The orbital optimization is achieved through successive transformations of an orbital basis. The theory of the method is based on an extension of the 'generalized Brillouin theorem' which is presented in the text. The new VB-SCF method is a generalization of the molecular orbital MC-SCF method to permit the use of nonorthogonal orbitals. It, therefore, encompasses the MC-SCF method as a restricted subclass. Several different forms of restriction may be imposed on the orbitals and on the optimization procedures. One of these only allows orbitals centered on the same atom to mix during optimization and in this way generates optimal hybrid orbitals, which it is expected will improve to be of particular interest in providing simple qualitative descriptions of the chemical bond. Test calculations are presented for LiH, He_2^+, and for the ground-state potential energy curve of OH. The VB-SCF wave function and optimized orbitals may be used as a starting point for the construction of a larger multistructure valence-bond wave function which the authors term a VB-CI function. The VB-SCF and VB-CI results presented in the paper show that the method is capable of yielding very accurate molecular potential energy curves. (54 refs.)

65854 Comment on: 'A quantum analog to the classical quasiperiodic motion' [and reply]. S.Mukamel (Dept. of Chem., Univ. of Rochester, Rochester, NY, USA), G.Hose, H.S.Taylor.
J. Chem. Phys. (USA), vol.78, no.9, p.5843-6 (1 May 1983).
Hose and Taylor's article (ibid., vol.76, no.11, p.5356, 1982) on the conventional local stability condition of the Wigner-Brillouin perturbation series, suggesting that it may function as a means for identification of quantum mechanical levels corresponding to classical quasiperiodic motion, is discussed. Mukamel's criticisms are rebutted in Hose and Taylor's reply. They state that the comment is based on several misconceptions. (9 refs.)

65855 On the quantum defect method. I.Bulboaca (Inst. de Fizica si Inginerie Nucleara, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.10, p.891-904 (1982). In Rumanian.
After a brief presentation of this method designed for calculations of atomic structures, the author examines a one-channel and a two-channel problem respectively. Calculation methods based on empirical data are proposed, and the results are compared with those previously reported in literature. (9 refs.)

Dynamic representation of quantum chemical results using computer graphics: molecular rearrangements, art or science? ....See Entry 68759

31.20 SPECIFIC CALCULATIONS AND RESULTS

65856 Preliminary study of the linear muffin-tin orbital method. Zhang Kai-ming (Modern Phys. Inst., Fudan Univ., Shanghai, China), Wang Liang-sheng.
Acta Phys. Sin. (China), vol.32, no.1, p.57-63 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The linear Muffin-tin orbital method (LMTO) is studied. In applying this method to the calculations of some molecules, the parameters have been carefully chosen, the effects of the choice of parameters on the self-convergence and the final results have been investigated. Due to the limitation of the computer available, the calculations have been carried out only for diatomic molecules. The results obtained agree fairly well with experimental results. (16 refs.)

65857 Time-dependent Hartree-Fock theory and its multiconfiguration generalization. R.McWeeny (Istituto di Chimica Fisica, Univ. di Pisa, Pisa, Italy).
THEOCHEM (Netherlands), vol.10, p.1-14 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Recent progress in time-dependent Hartree-Fock (TDHF) theory is reviewed, with emphasis on new techniques and further generalizations. The formalism proposed by Moccia (1974) is sufficient to admit optimization of parameters of all kinds in a variational wavefunction determined by use of the Frenkel principle, the form of the reference function being arbitrary. Various approximations and methods of solution are discussed and an illustrative application, to the helium atom, is reported. (24 refs.)

65858 A theoretical investigation of the properties of free radicals. G.Leroy (Lab. de Chimie Quantique, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
THEOCHEM (Netherlands), vol.10, p.175-88 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Results of unrestricted Hartree-Fock calculations (at various basis set levels) are used for rationalizing static and dynamic properties of free radicals. A detailed classification of these species, based on their electronic structure and their stabilization energy, is presented. The latter concept is shown to be a good tool for analyzing the self-reactivity of free radicals. (22 refs.)

65859 Energy levels for a system of coupled oscillators. A.Requena, R.Pena (Phys. Chem. Dept., Murcia Univ., Murcia, Spain).
THEOCHEM (Netherlands), vol.10, p.221-6 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The authors formulate a self-consistent field description of coupled anharmonic oscillators including an hypervirial treatment of the matrix elements required to solve the SCF equations. The energy levels are calculated without the explicit knowledge of the wave-functions and the only information needed is the energy of the unperturbed states. A numerical application to two pairs of anharmonically coupled oscillators is made, and a system of three anharmonically coupled oscillators is solved. (13 refs.)

65860 Approximated eigenenergy for doubly perturbed oscillators. A.Requena, R.Pena (Phys. Chem. Dept., Murcia Univ., Murcia, Spain).
THEOCHEM (Netherlands), vol.10, p.227-30 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
By using both hypervirial and Hellmann-Feynman theorems, the energy levels for an anharmonic oscillator described by a potential of the type $w^2/2x^2+\lambda/4x^4+n/6x^6$ are calculated without the knowledge of the eigenfunctions. A comparison with the exact results is made including the Pade approximants to the perturbation series of the energy. (7 refs.)

65861 Ab initio molecular orbital calculations of the first two adiabatic ionizations of the water dimer. L.A.Curtiss (Chem. Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.442-6 (15 April 1983).
Ab initio molecular orbital methods have been used to study the first two adiabatic ionizations of the water dimer. Both ionizations cause considerable geometrical rearrangements in the water dimer structure. Good agreement is found with experiment on the difference between the vertical and adiabatic energies for the first ionization. (14 refs.)

65862 Ab initio valence-electron-only calculations on molecules: test application to NaCl. S.C.Leasure, T.P.Martin, G.G.Balint-Kurti (School of Chem., Bristol Univ., Bristol, England).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.447-52 (15 April 1983).
A new method for performing valence-electron calculations is applied for the first time to a molecular system. The method contains no adjustable parameters and in the limit of a large basis set converges on the all-electron frozen-core results. (18 refs.)

65863 Vibrational excitation following the S1s core ionization of CS. S.Canuto (Dept. de Fisica, Univ. Federal de Pernambuco, Recife, Brazil), L.M.Reyes.
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.591-4 (22 April 1983).
Ab initio non-relativistic spin-unrestricted Hartree-Fock calculations are performed on Cs and its S1s core-ionized state. Geometrical relaxation is investigated. As in the corresponding first-row CO, relaxation greatly influences the vibrational band profile. The one-particle vibrational picture leads to bond-length shortening whereas relaxation and direct calculations indicate a slight bond-length increase, leading to a predicted small vibrational broadening. (35 refs.)

65864 Theory of magnetic susceptibilities and NMR chemical shifts in terms of localized quantities. III. Application to hydrocarbons and other organic molecules. M.Schindler, W.Kutzelnigg (Lehrstuhl fur Theoretische Chem., Ruhr-Univ. Bochum, Bochum, Germany).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1360-70 (9 March 1983).
For pt.II see J. Chem. Phys., vol.76, p.1919 (1982). A method for the ab initio calculation of magnetic susceptibilities (χ) and chemical shifts (σ) based on individual gauge for localized orbitals (IGLO) is applied to a wealth of organic molecules. Calculations with a double-ζ basis are possible for molecules as large as Me_4Si or benzene and lead to acceptable results. For somewhat larger basis sets with polarization functions, good agreement with experiment is found. The anisotropies of χ and σ are also obtained satisfactorily. Both χ and σ are directly obtained as sums of contributions of the various localized orbitals that have a direct physical meaning. These contributions are to some extent transferable, which allows the construction of an ab initio increment system. (44 refs.)

65865 On the monotonicity of the atomic electron momentum density and shell structure of the radial momentum density. S.R.Gadre, S.Chakravorty (Dept. of Chem., Univ. of Poona, Pune, India), R.K.Pathak.
J. Chem. Phys. (USA), vol.78, no.7, p.4581-4 (1 April 1983).
Numerical investigations on the monotonicity of the electron momentum densities for atoms helium through xenon, using single-zeta and near Hartree-Fock wave functions, have been carried out. It has been noted that, in general, atoms with their ultimate *p* shells doubly occupied or more tend to show a nonmonotonic electron momentum density. An exception to this is the monotonic behavior exhibited by the elements helium through neon employing single-zeta wave functions. A study of the shell structure in momentum space for the above atoms reveals that all these atoms display, at the most, three maxima in their radial momentum density. (8 refs.)

65866 On the basis set superposition error in potential surface investigations. I. Hydrogen-bonded complexes with standard basis set functions. J.M.Leclercq, M.Allavena (Centre de Mecanique Ondulatoire Appl. CNRS, Paris, France), Y.Bouteiller.
J. Chem. Phys. (USA), vol.78, no.7, p.4606-11 (1 April 1983).
The basis set superposition errors on the energy of the complexes $FH...OH_2$ and FH...NCH are investigated at the SCF level. The two-dimension energy-potential surfaces, corresponding to the slow and fast frequencies of the hydrogen bridge, are calculated without and with the counterpoise correction. The corresponding quadratic, cubic, and quartic force constants are computed. Similar calculations are reported for the electric dipole moment and its derivatives. These investigations show that the basis set superposition error: (i) does not decrease, in the vicinity of the equilibrium configuration of the complex, when standard high-quality basis sets are used; (ii) shifts the minimum of the potential surface, distorts this surface, and changes the force constants in a significant but not drastic manner. (29 refs.)

65867 Isoelectronic changes in the Hartree-Fock properties of atoms. V.R.Babu, K.Gopalakrishna, K.D.Sen (School of Chem., Univ. of Hyderabad, Hyderabad, India).
J. Chem. Phys. (USA), vol.78, no.7, p.4779-80 (1 April 1983).
The systematic variation of the Hartree-Fock (HF) estimates of the nuclear electron attraction energy V_{ne}, electron-electron repulsion energy V_{ee}, and the total electronic energy E^{HF}, respectively within an isoelectronic series of atoms has been noted in the literature. Castro et al. (1981) have shown using the Z^{-1} perturbation expansion of E^{HF} that the second finite differences $-D^2$ in E^{HF} remain constant within an isoelectronic series. In addition, a constant increment of 0.25 in $-D^2$ in going from N to $N+1$ electron series has been noted by these authors. The systematics in $-D^2$ have been subsequently attributed to the variation in $\langle 1/r_1 \rangle$ within the series. The purpose of the communication is to report the result that the second differences in the eigenvalue sum $\Sigma \nu_i \epsilon_i$ within an isoelectronic series display exactly the same systematics as those observed in the case of E^{HF}. The authors' result follows from the Z^{-1} expansion of E^{HF}, V_{ne}, and V_{ee}. (10 refs.)

65868 Comment on ab initio calculation of spin densities in hydrocarbon radicals. D.M.Chipman (Radiation Lab., Univ. of Notre Dame, Notre Dame, IN, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4785-6 (1 April 1983).
Recently, the author reported calculations of hydrocarbon radical hyperfine coupling constants (HFC), using the spin-projected unrestricted Hartree-Fock (PUHF) method (1979). More recent research that has led to a much better understanding of the problem leads him to update the earlier study. The usual (unprojected) UHF model is formally closer to the much more soundly based single-excitation configuration interaction (SECI) model than is PUHF. Agreement with both SECI and experiment is much worse with UHF than PUHF. However, despite this much poorer absolute numerical agreement, the calculations indicate that the UHF model describes many HFC trends better than PUHF. (6 refs.)

65869 A comment on 'Numerical Hartree-Fock-Slater calculations on diatomic molecules' by A.D. Becke [and addendum]. B.I.Dunlap (Naval Res. Lab., Washington, DC, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4787-8 (1 April 1983).
Recently Becke (ibid., vol.76, p.6037, 1982) developed a quite promising, completely numerical approach for solving the Hartree-Fock-Slater (HFS) equations for diatomic molecules. Due to the variational properties of his methodology, he was able to explicitly demonstrate an accuracy of 0.1 eV in his calculation of the dissociation energies of diatomic molecules. The author's approach has similar variational properties to that of Becke but uses linear combination of Gaussian type orbitals (LCGTO) rather than numerical bases. However, in this approach, the problem of basis set incompleteness makes an estimate of the accuracy of dissociation energies less straightforward. Based on an analysis of similar Hartree-Fock calculations he conservatively estimated these dissociation energies to be accurate to 0.2 eV. Thus the results are apparently inconsistent; the worst discrepancy being 0.4 eV for N_2. In order to make a truly accurate comparison between the present numerical method and the LCGTO-$X\alpha$ method, Becke has carried out additional dissociation energy calculations. These new calculations are fully spin unrestricted, and the 1*s* core orbitals are no longer frozen. The resulting spin-unrestricted dissociation energies are presented. (5 refs.)

65870 Second and third derivatives of variational energy expressions: application to multiconfigurational self-consistent field wave functions. P.Pulay (Dept. of Chem., Univ. of Arkansas, Fayetteville, AR, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5043-51 (15 April 1983).
General analytical expressions are given for the second and third derivatives of constrained variational energy expressions. It is pointed out that variational energy expressions and odd-order derivatives have a distinct advantage over nonvariational (e.g., perturbative) energy expressions and even-order derivatives. In particular, the first-order wave function suffices to determine the derivatives of the variational energy up to third order. The coupled-perturbed multiconfigurational SCF (MC-SCF) equations, obtained from the general results, are equivalent, with minor corrections, to the ones very recently presented by Osamura, Yamaguchi, and Schaefer (1982). Explicit expressions are given for the second and third derivatives of the MC-SCF energy. Computational implementation is briefly discussed. (35 refs.)

65871 Accurate ab initio potential curves using bond functions. J.S.Wright, R.J.Williams (Ottawa-Carleton Inst. for Res. & Graduate Studies in Chem., Ottawa, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.5264-6 (15 April 1983).
The authors calculate the total binding energy and associated properties (such as vibrational energy levels) using small basis sets and modest configuration interaction for HF. A typical ab initio calculation auing Guassian orbitals on HF is considered in which a double-zeta plus polarization basis set is used. (14 refs.)

65872 Localized orbitals and the theory of separated pairs. W.L.Luken (Paul M. Gross Chem. Lab., Duke Univ., Durham, NC, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5729-32 (1 May 1983).
The relationship between the theory of separated pairs and localized molecular orbitals is examined by approximating the energy of a separated pair wave function as the sum of two terms. The first term determines a linear vector space similar to that spanned by the canonical SCF orbitals. The second term determines a basis for that space which corresponds to a localized representation of the wave function. (31 refs.)

65873 Ab initio studies of weakly bound complexes between some nonpolar molecules and hydrogen fluoride. A.M.Sapse (John Jay Coll., City Univ. of New York, New York, NY, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5733-7 (1 May 1983).
The complexes formed by nonpolar molecules and HF are studied with 6-31G, 6-31G*, 6-31G** Gaussian basis sets. Geometries and binding energies are determined and estimation of the correlation effects is provided using the Moller-Plesset perturbation theory (MP2). The binding energy dependence on the polarizability of the nonpolar molecules is discussed. (12 refs.)

65874 Ab initio studies of the CO_2-HF and N_2O-HF complexes. A.M.Sapse (John Jay Coll., City Univ. of New York, New York, NY, USA), J.M.Howell.
J. Chem. Phys. (USA), vol.78, no.9, p.5738-40 (1 May 1983).
Ab initio calculations are used to confirm the geometries found experimentally by Klemperer et al. (1981) for the CO_2-HF and N_2O-HF complexes. (10 refs.)

65875 On a molecular nuclear tunnelling effect involving more than a million basic vibrational wave functions. Theoretical study of bullvalene. P.Blaise (Dept. de Chimie, Univ. de Valenciennes et du Hainaut-Cambraisis, Valenciennes, France), R.Bouamrane, O.Henri-Rousseau, N.Merad, M.Nafi.
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.2, p.173-81 (Feb. 1983). In French.
Only some basis vibrational wave functions in the molecular nuclear tunnelling effects are generally observed. There is in bullvalene a nuclear tunnelling effect involving more than one million vibrational wave functions. The theoretical study of the effect leads the authors to consider the existence of a great number of vibrational energy bands. The determination of the band widths supposes the diagonalisation of a $(10!/3)\times(10!/3)$ hamiltonian matrix. This is performed by using the tensorial product properties. Then the experimental properties of bullvalene (geometry, spectroscopy and entropy) are studied in the light of the tunnelling effect. (15 refs.)

65876 Information on programs for quantum-chemical calculations of the electronic structure of molecular systems.
J. Struct. Chem. (USA), vol.23, no.3, p.472-83 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.170-80 (May-June 1982). [received: Feb. 1983]
In compliance with a resolution of the Coordinating Conference on Quantum Chemistry (Cherogolovka, 1981), the Center for Information on Programs for Quantum-Chemical Calculations (Institute of Organic Chemistry of the Academy of Sciences of the USSR, G.M. Zhidomirov) and the Specialized Reserve of Quantum-Chemical Programs, SRQP (SFKP) (Institute of Chemical Kinetics and Combustion, Siberian Branch, Academy of Sciences of the USSR, P.V. Schastnev) have prepared an information report on programs for quantum-chemical calculations of the electronic structure of molecular systems, available in various research centers. I.A. Abronin (Institute of Organic Chemistry of the Academy of Sciences of the USSR) and O.I Bel'chenko (Institute of Chemical Kinetics and Combustion, Siberian Branch, Academy of Sciences of the USSR) took part in the compilation of the information report. It is proposed in the future to publish periodically similar reports containing information on newly developed or appropriated programs, and also programs received in the SRQP. The information on the programs has been systematized in a single format, containing information on the holders of the program, the name of the program, its principal characteristics and its possibilities in algorithmic language. Information on programs for nonempirical calculations is given first, followed by programs in which the approximation of local exchange potential is realized (schemes of the X_α type), and finally by a summary of programs for semiempirical calculations. (no refs.)

65877 Molecular orbital theory of chain propagation in free-radical addition polymerization of vinyl monomers. Yu Tongyin, Yang Yuliang, Oi Nianhua, Sun Meng (Dept. of Chem., Fudan Univ., Shanghai, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1178-81 (Nov. 1982). [received: April 1983]
The process of chain propagation in free-radical polymerization of vinyl monomers, in a general sense, is the variation of the π-orbital of chain free-radical and monomer during transition. Hence, if it is possible to calculate the energy level of the π-orbitals at different stages, one can get the energy curve of the process, and thus correlate with the activation energy of addition polymerization. The authors by taking advantage of the molecular orbital theory proposed by Tang in 1975, and with the introduction of certain new assumptions, correlate the variation of the π-molecular orbital energy during the chain propagation in addition polymerization with the activation energy of chain propagation. (8 refs.)

65878 Quantum-chemical determination of additive bond polarizabilities in polyatomic molecules. S.G.Semenov, A.V.Tulub.
Opt. & Spectrosc. (USA), vol.53, no.3, p.245-8 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.415-20 (Sept. 1982). [received: May 1983]
A method has been proposed for calculating the additive bond polarizabilities in polyatomic molecules, based on the localization of the MO LCAO by the standard density matrix method. The chemical bonds of the molecule are regarded as its anisotropic structural units, characterized by characteristic polarizability tensors. The sum of these tensors gives the polarizability tensor of the molecule; i.e. the bond polarizabilities are additive. At the same time, their transferability is not assumed. To increase the accuracy of the calculations it is recommended that use be made of the SCF MO LCAO method with additional conditions ensuring agreement between the theoretical and experimental values of the molecular polarizabilities. The proposed formalism has been illustrated by calculations of the additive bond polarizabilities in the hydrogen cyanide and cyclohexane molecules. Quantum-chemical definitions of the dispersion components of the energy of interaction of large molecules and the energy of their adsorption on a crystal surface have been given in terms of the additive bond polarizabilities with allowance for many-particle van der Waals forces. (16 refs.)

65879 Investigations of some sulphur halides—an application of the pseudopotential method. T.Kruger, H.Preuss (Inst. fur Theoretische Chem., Univ. Stuttgart, Stuttgart, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.463-72 (April 1983).
Semilocal pseudopotentials are used in combination with a density-functional approximation for the correlation energy and special optimized basis sets to investigate the sulphur halides SF, SF_2, SF_3, FSSF, SSF_2, SCl, SCl_2, ClSSCl and $SSCl_2$. It turns out that the inclusion of d-orbitals in the basis set plays a significant role with respect to the quality of the calculated molecular parameters. Properties of SF_3 are calculated for the first time, and the differences between the disulphur difluorides and disulphur dichlorides are explained. (34 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ... See Entry 64573

Molecular form factors and photon coherent scattering cross sections of water ...... See Entry 64602

Ab initio SCF CI study of the electronic structure and spectrum of CuF_2 ...... See Entry 65888

Prolate-spheroidal semiempirical model for some monoexcited states Π_g and Δ_g of Na_2 ...... See Entry 65900

Bond orbital framework for rapid calculation of environmental effects on molecular potential surfaces ...... See Entry 65906

Probabilities for electric quadrupole transitions between Rydberg states of atoms and ions ...... See Entry 65930

$N_{4,5}N_{6,7}X$ Coster-Kronig spectra of free Hg atoms ...... See Entry 65942

Infrared and Raman study and ab initio calculations of internal rotation in methylisopropenyl ether ...... See Entry 65984

Quantum-chemical calculation of NMR chemical shifts ...... See Entry 66028

Analysis of the ESR hyperfine coupling in mono- and bicyclic azine radical anions by means of calculated spin densities ...... See Entry 66037

Using nuclear resonance excitation to observe united atoms in symmetric ion-atom collisions ...... See Entry 66110

Atomic orbital expansion study of electron capture in $H^+ + Li$ and $He^{2+} + Li$ collisions ...... See Entry 66131

New directions in low energy electron molecule collision calculations ...... See Entry 66146

Thermodynamic functions of diatomic selenium ...... See Entry 66662

Molecular orbital study on the interaction of Ni and Cu atoms with oxygen-containing organic ligands and its implication to adsorption .... See Entry 67374

Polarization model for NH_3-H-H_2O proton transfer reaction .. See Entry 68769

31.20D Complete ab initio calculations (exact or nearly exact calculations on small species)

65880 A study of the helium isoelectronic series using rational trial functions. P.Jolly, K.V.Sane, R.P.Saxena, P.K.Srivastava (Dept. of Phys. & Astrophys., Univ. of Delhi, Delhi, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.573-83 (Nov. 1982). [received: April 1983]
The study of the ground state of helium atom using variational functions of the Pade type is extended to the corresponding isoelectronic sequence with $Z=3$ to $Z=10$. It is shown that the earlier observation that the nonlinear function of any order is superior to the corresponding linear function, continues to hold good for the entire isoelectronic sequence. (8 refs.)

Molecular orbital calculation of several ices using the pseudolattice method ...... See Entry 66923

Molecular orbital study of the protonation of DNA bases ...... See Entry 68921

31.20E Ab initio LCAO and GO SCF calculations

Frequency-dependence of the nuclear electric shielding in the HF molecule via equation-of-motion-approaches ...... See Entry 65894

A theoretical study of the solvent effect on dissociation reactions. The role of the first solvation shell ...... See Entry 68760

31.20G Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)

65881 Search for a unique set of parameters in IOC-ω technique. K.B.Lal, V.K.Agrawal, A.K.Srivastava, B.Krishna (Chem. Dept., Univ. of Allahabad, Allahabad, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.994-5 (Dec. 1982). [received: April 1983]
A new set of parameters has been proposed in the framework of IOC-ω technique and the efficacy of the technique with the proposed set of parameters has been demonstrated by calculating the ionization potentials for alternant, non-alternant and heteromolecules. The values obtained compare favourably well with previously calculated values as well as experimental values wherever available. (24 refs.)

65882 Coordination in benzene dimer cation radical. S.A.Milosevich, K.Saichek, L.Hinchey, W.B.England, P.Kovacic (Dept. of Chem., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1088-90 (9 March 1983).
Ab initio MO calculations are used to characterize coordinations in benzene dimer cation. Binding occurs for all arrangements which allow π overlap between parallel rings. Parity (orbital symmetry) is approximately conserved, and two manifolds which correspond to opposite parities are predicted. Stable species in either manifold exhibit slippery, spongy bonds. In the odd (even) manifold, these are 1-coordinate-like (6-coordinate-like) dimers which are bound by $\sim$12(11) kcal/mol at inter-ring distances of $\sim$0.26(0.32) nm. Analysis of the results suggests that such parity manifolds are generally expected of alternant aromatic dimer cations, and also to some extent of their oxidomer analogues. (35 refs.)

65883 Approximation of frozen Xα orbitals in the theory of X-ray and electronic spectra. K.M.Neiman, A.V.Kondratenko, V.A.Nasluzov, L.V.Molchanova, P.V.Abramov (Inst. of Inorganic Chem., Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.349-54 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.30-6 (May-June 1982). [received: Feb. 1983]
The approximation of frozen orbitals for the calculation of X-ray and electronic spectra has been developed within the framework of the Xα method. The concept of the energy of occupied and unoccupied orbitals has been refined, and a definition of the energy of relaxation in this method has been given. The results of calculations for the Ar atom and the N_2, CO, SO_2, and SF_6 molecules have been given. (31 refs.)

Electronic structure of $H_n{}^+$ and $HeH_n{}^+$ clusters ...... See Entry 66172

31.20N Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCILO methods, etc.)

65884 INDO-MO study of δ-CH acetyl-proton couplings in aliphatic α-acetoxy radicals. K.K.Karukstis, P.Smith (Dept. of Chem., Duke Univ., Durham, NC, USA).
J. Magn. Resonance (USA), vol.52, no.2, p.202-10 (April 1983).
Recent studies in the authors' laboratory have demonstrated a successful technique for determining preferred conformations in simple aliphatic α- and β-formyloxy radicals, $.C(X_1)(X_2)OCHO$ and $.C(X_1)(X_2)C(X_3)(X_4)OCHO$, respectively, using the results of extensive INDO-MO calculations and liquid-phase, experimental measurements of EPR long-range formyl-proton couplings in these species. The paper extends this type of study by way of an INDO investigation of a series of α-acetoxy radicals, namely, $.CH_2OC(O)CH_3$, $.CH(CH_3)OC(O)CH_3$, $.CH(CH_2CH_3)OC(O)CH_3$, $.CH(CH(CH_3)_2)OC(O)CH_3$, $.CH(CH_2OH)OC(O)CH_3$, $.CH(CH_2NH_2)OC(O)CH_3$, and $.C(CH_3)_2OC(O)CH_3$, for which experimentally determined EPR coupling-constant data are available, and confirms that the δ-CH acetyl-proton couplings observed experimentally can be sensitive probes of radical stereochemistry. Specifically, the study predicts and verifies that, for these radicals, the variations in the size of the experimentally determined δ-CH acetyl-proton coupling found to result from alterations in the nature of the substitution at the radical center arise from the accompanying changes in radical conformation. Furthermore, the preferred conformations of these α-acetoxy radicals found in the INDO investigation are in general

agreement with similarly determined conformations for structurally analogous .$C(X_1)(X_2)OCHO$ radicals. (22 refs.)

Change in the electronic structure of the thiocyanate ion on coordination ....See Entry 66009

Transmission of spin-spin coupling constants through different paths in bicyclo(2,2,1)heptane: their calculation using inner projections of the polarization propagator ....See Entry 66011

How restricted are partially restricted MO calculations? A few comments on the calculations of spin-spin coupling pathways at the INDO/FPT level ....See Entry 66023

Highly resolved electronic spectra and electronic structure of benzo[f]quinoxaline ....See Entry 66059

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 ....See Entry 66953

A theoretical study of the solvent effect on dissociation reactions. The role of the first solvation shell ....See Entry 68760

31.20P Other semi-empirical calculations (Hückel, generalized Hückel, PPP methods, etc.)

65885 Evaluation of some molecular properties of Di- & Tri-substituted acetophenones by a (PPP-CI) method. D.Gupta (Dept. of Phys., Jammu Univ., Jammu, India), R.M.P.Jaiswal.
Indian J. Pure & Appl. Phys., vol.20, no.12, p.945-8 (Dec. 1982). [received: April 1983]
Molecular properties, viz. ionization potential, electron affinity, π-electron dipole moment and charge distribution of fifteen di- and tri-hydroxy and methoxy substituted acetophenones have been evaluated explicitly, using a semiempirical SCF-MO Pariser-Parr-Pople configuration interaction method. The calculated results thus obtained have been compared with those of available experimental investigations. (26 refs.)

Equilibrium geometry and dynamics of the valence excited states of 1,3-butadiene ....See Entry 65897

31.20R Valence bond calculations (ab initio or not)

The valence-bond self-consistent field method (VB-SCF): theory and test calculations ....See Entry 65853

31.20T Electron correlation and CI calculations

65886 Theoretical study of electrolytic ring opening of oxirane. Y.Jean, F.Volatron, Nguyen Trong Anh (Lab. de Chimie Theorique, Univ. de Paris-Sud, Orsay, France).
THEOCHEM (Netherlands), vol.10, p.167-73 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
SCF+CI calculations are performed to investigate the potential energy surface associated with the thermal C-C ring opening of oxirane (CH_2OCH_2). Contrarotatory, disrotatory and nonsynchronous processes are studied, and the results discussed with respect to experimental data (Huisgen and coll.) which indicate a loss of stereoselectivity in the ring opening reactions of some substituted oxirane molecules. (27 refs.)

65887 Nonempirical calculations of magnetic properties by the SOS-CI perturbation theory according to Nakatsuji. V.Galasso (Istituto di Chimica, Univ. di Trieste, Trieste, Italy).
THEOCHEM (Netherlands), vol.10, p.201-6 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
SOS-CI calculations at ab-initio level according to Nakatsuji's formalisms are presented for the nuclear spin-spin-coupling constants, magnetic shielding constants and diamagnetic susceptibilities for several simple compounds. The satisfactory results indicate that the SOS-CI formalism of Nakatsuji may be a practical alternative to the time-consuming CHF procedures in order to obtain reliable reproduction of second-order molecular magnetic properties. (7 refs.)

65888 Ab initio SCF CI study of the electronic structure and spectrum of CuF_2. S.Larsson, B.O.Roos (Dept. of Chem., Univ. of Lund, Lund, Sweden), E.M.Siegbahn.
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.436-41 (15 April 1983).
MC SCF and contracted CI calculations have been performed for the three ligand-field states of CuF_2 and also for two charge-transfer states. With the most extensive basis set the calculated d-d transition energies, including a Davidson correction for cluster effects, are 4150 cm^{-1} ($^2\Pi_g$) and 10560 cm^{-1} ($^2\Delta_g$). These calculations were made with 98 basis functions, including f orbitals on Cu and d orbitals on F. To check the charge distribution in the molecule, calculations of the ESR g factors were also made at the SCF and CI levels of approximation. Resulting CI values are $g_\parallel=1.93$ (1.91) and $g_\perp=2.76$ (2.60), with corresponding experimental numbers in parentheses. (20 refs.)

65889 Full CI extrapolation compared to explicit full CI for H_2O in a double-zeta basis. P.G.Burton, P.D.Gray (Chem. Dept., Univ. of Wollongong, Wollongong, NSW, Australia).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.453-7 (15 April 1983).
Successive *m*Main subspace MRD CI variational energies are shown to form the basis of an extrapolation of high precision to the corresponding exact full CI energy for H_2O in a double-zeta basis. While the highest *m*Main subspaces considered ($m=1, 3, 6, 11, 18, 26, 35$ and 45) involved only ≈5% of the full CI space of 256473 SAFs, the error due to extrapolation to the full CI result is only 0.21 kJ mol^{-1}, comparable to the precision to which the authors compute the CI energies (≈0.05 kJ mol^{-1}). (19 refs.)

65890 Accurate basis sets for atomic configuration interaction calculations. Ying Ming Poon (Dept. of Phys., Univ. of Hong Kong, Hong Kong).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.113-16 (April 1983).
A Hartree-Fock-Slater program and a compatible box potential program are developed to generate complete basis sets for configuration interaction calculations using many-body perturbation theory. Examples are given for Pr^{3+} and Np^{3+} ions. Good orthogonality between basis functions is obtained even for large values of n and l. (10 refs.)

65891 Calculation of the fourth-order triple-excitation contribution to MB RSPT by using spatial symmetry properties of molecules. J.Noga (Dept. of Phys. Chem., Faculty of Sci., Comenius Univ., Bratislava, Czechoslovakia).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.117-24 (April 1983).
A new algorithm is described for calculating the triple-excitation contribution to the fourth-order Many-Body Rayleigh-Schrodinger Perturbation Theory (MB RSPT). Exploitation of spatial symmetry properties of molecules is an inherent feature. Evaluation of zero intermediate values is eliminated from the calculation at the very outset of the program by a single numerical test of integrals. The algorithm is very efficient particularly in calculating electron correlation energies of symmetric molecules; but it can be applied successfully to calculate energies of arbitrary closed shell systems. It does not require much storage, since only a small fraction of the non-zero integrals must be held in core memory at the same time. Some examples of applications are appended. The method can be applied to calculate each contribution to MB RSPT. Program listing. (15 refs.)

65892 CASSCF/CI calculations for first row transition metal hydrides: The TiH($^4\Phi$), VH($^5\Delta$), CrH($^6\Sigma^+$), MnH($^7\Sigma^+$), FeH($^{4,6}\Delta$), and NiH($^2\Delta$) states. S.P.Walch, C.W.Bauschlicher,Jr. (Polyatomics Res. Inst., Mountain View, CA, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4597-605 (1 April 1983).
By consideration of atomic coupling arguments and interaction of $4s^23d^n$ and $4s^13d^{n+1}$ derived terms, the ground states of the transition metal hydrides are predicted to be TiH($^4\Phi$), VH($^5\Delta$), CrH($^6\Sigma^+$), MnH($^7\Sigma^+$), FeH($^4\Delta$), CoH($^3\Phi$), and NiH($^2\Delta$). All of these systems have been studied by a CASSCF/CI(SD) procedure with the exception of CoH. The calculated parameters derived from the CASSCF/CI(SD) potential curves are in good agreement with the experimental values where known (no information exists for TiH and VH). Inclusion of atomic correlation leads to significantly better agreement with experiment particularly for R_e. These improvements are related to a more balanced description of the atomic states in the correlated wave functions. (32 refs.)

65893 Interaction between two Co atoms. An all electron ab initio HF-CI investigation. I.Shim, K.A.Gingerich (Dept. of Chem., Texas A&M Univ., College Station, TX, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5639-8 (1 May 1983).
In the present work the authors present all electron ab initio Hartree-Fock (HF) and configuration interaction (CI) calculations of the 84 low-lying electronic states resulting from the interaction between two Co atoms in the $^4F(3d)^8(4s)^1$ term. The basis set used was of double zeta quality in general, but the $3d$ orbital was represented by a triple zeta function. The calculations were performed on the same degree of accuracy for all 84 states. The predicted $^5\Sigma_g{}^+$ ground state of the Co_2 molecue is due to the natural orbital occupation
$(3d\sigma_g)^{2.00}(3d\pi_u)^{3.09}(3d\delta_g)^{3.02}(3d\delta_u)^{2.98}(3d\pi_g)^{2.91}(3d\sigma_u)^{2.00}(4s\sigma_g)^{1.94}(4s\sigma_u)^{0.06}$.
From the calculated spectroscopic data of the Co_2 molecule, the authors have estimated the equilibrium distance to be 46 au and the vibrational frequency as 240 cm^{-1}. The chemical bond between the Co atoms is a single bond almost entirely due to the $4s\sigma_g$ molecular orbital. The 84 low-lying electronic states make a large contribution to the partition function, resulting in a lowering of the experimental dissociation energy of the Co_2 molecule. Reevaluating the data by Kant and Strauss resulted in an experimental dissociation energy $D_0{}^0$ of 22±6 kcal mol^{-1} or 93±25 kJ mol^{-1}. (20 refs.)

Accurate ab initio potential curves using bond functions ....See Entry 65871

Evaluation of some molecular properties of Di- & Tri-substituted acetophenones by a (PPP-CI) method ....See Entry 65885

Theoretical autoionisation rates of the $1s2p^2\ ^2D$ and $1s2s2p\ ^2P^0$ states of Li ....See Entry 65933

Vibrational frequencies for silaacetylene and its silylidene and vinylidene isomers [and molecular structures] ....See Entry 65955

Highly resolved electronic spectra and electronic structure of benzo[f]quinoxaline ....See Entry 66059

Electronic structure of $H_n{}^+$ and $HeH_n{}^+$ clusters ....See Entry 66172

An ab initio study of the reaction $Be(^3P)+H_2(^1\Sigma_g{}^+)\rightarrow BeH(^2\Sigma^+)+H(^2S)$ ....See Entry 68768

Single and triplet energy surfaces of NiH_2 ....See Entry 68773

31.30 CORRECTIONS TO ELECTRONIC STRUCTURE

65894 Frequency-dependence of the nuclear electric shielding in the HF molecule via equation-of-motion-approaches. P.Lazzeretti, E.Rossi, R.Zanasi (Istituto di Chimica Organica, Modena, Italy).
THEOCHEM (Netherlands), vol.10, p.207-12 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Investigates the linear response of the hydrogen fluoride molecule in the ω range from zero up to the lower electronic resonance frequencies. An extended basis set of 72 contracted Gaussian functions has been prepared to build up LCAO-SCF molecular orbitals forming the quasivacuum $|\psi_{SCF}>$ ground state. The contraction scheme is (14s8p4d/8s3p1d)..> [9s6p4d/6s3p1d], which gives a near HF energy, −100.069661 hartree. The RPA equations have been solved within the first-order polarisation propagator approach. The authors note that the RPA is equivalent with the Coupled Hartree-Fock (CHF) or Time-Dependent Hartree-Fock (TDHF) approach. (12 refs.)

65895 On relativistic contributions to the bonding in Cu_2. R.L.Martin (Theoretical Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5840-2 (1 May 1983).
In a study of the Cu_2 dimer, Bauschlicher, Walch, and Siegbahn (BWS) (1982, 1983) found that after performing extensive valence-electron MCSCF calculations followed by configuration interaction including all single and double excitations from the MCSCF reference space, the computed bond length $4.35a_0$ remained roughly $0.15a_0$ longer than the experimental result. This discrepancy is approximately an order of magnitude larger than what one would expect from this level of theory based on experience with first-row diatomics. BWS pointed out that the error in r_e is about what one would expect for the relativistic bond contraction in Cu_2 given the atomic $4s$ orbital contraction ($0.065a_0$) obtained by Desclaux (1973). On the other hand, Pelissier (1981) has performed effective core potential perturbation theory calculations for Cu_2 which give $r_e=4.25a_0$, within $0.05a_0$ of experiment, and implying a quite small relativistic contraction. In order to avoid these indirect assessments of the importance of relativity, a direct evaluation of the dominant relativistic operators has been performed for Cu_2. (10 refs.)

65896 A comparison of different variants of the multi-configuration Dirac-Fock description of fine structure in light atoms. N.C.Pyper (Dept. of Theoretical Chem., Univ. of Cambridge, Cambridge, England).
J. Phys. B (GB), vol.16, no.8, p.L211-15 (28 April 1983).
Fine structure in light atoms is well described by the single-manifold extended average level (EAL) variant of relativistic multi-configuration Dirac-Fock (MCD) theory if the contribution from the Breit interaction is studied. The fine structure predicted by the optimal level (OL) variant is unreliable unless the corresponding result obtained by performing the OL calculation with an

artificially large value of the velocity of light is subtracted. Since, after this subtraction, the results differ little from the EAL predictions, it is concluded that it is not worthwhile to perform the series of calculations needed to predict reliable fine structure in the OL method. (23 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ... See Entry 64573

Relativistic effects on chemical properties ... See Entry 64635

Nonempirical calculations of magnetic properties by the SOS-CI perturbation theory according to Nakatsuji ... See Entry 65887

$N_{4,5}N_{6,7}X$ Coster-Kronig spectra of free Hg atoms ... See Entry 65942

Electron energy spectrum in low-energy collisions of negative ions and atoms ... See Entry 66120

31.50 EXCITED STATES

65897 **Equilibrium geometry and dynamics of the valence excited states of 1,3-butadiene.** U.Dinur, R.J.Hemley, M.Karplus (Dept. of Chem., Harvard Univ., Cambridge, MA, USA).
J. Phys. Chem. (USA), vol.87, no.6, p.924-32 (17 March 1983).
Franck-Condon factors are calculated for alternative forms of the potential energy surface of the $1^1B_u{}^+$ excited state of butadiene. A comparison of these results with the experimental absorption spectrum indicates that the $1^1B_u{}^+$ state of butadiene may have a nonplanar minimum, but that the twist around a terminal bond is no larger than 30°; for the $2^1Ag_g{}^-$ excited state larger distortions from planarity may occur. In treating the transition from a planar ground state to nonplanar excited states, it has been shown that a large number of modes and combination terms have significant Franck-Condon factors. The complex nature of the excited-state surfaces and the coupling between the $1^1B_u{}^+$ and $2^1A_g{}^-$ states are discussed and suggested as an explanation of some of the unusual photophysical properties of butadiene. (42 refs.)

65898 **Mesurement of photoionisation cross sections for the $7^2P_{3/2}$ and $6^2D_{3/2}$ excited states of caesium.** K.Gerwert, K.J.Kollath (Phys. Inst., Univ. Munster, Munster, Germany).
J. Phys. B (GB), vol.16, no.8, p.L217-21 (28 April 1983).
Relative photoionisation cross sections for the $7^2P_{3/2}$ and $6^2D_{3/2}$ excited states of caesium have been measured in the visible spectral range of the ionizing photon. The measurements have been performed using two pulsed dye lasers, pumped by the same excimer laser, for population of the excited states and for their photoionisation. The results for the $7^2P_{3/2}$ state show the theoretically expected smooth variation with wavelength, while the deep minimum predicted by theory for the $6^2D_{3/2}$ state has not been detected experimentally. (17 refs.)

65899 **The observation, identification and classification of resonances in Ne, Ar and Kr in the doubly excited states region.** H.W.Dassen, R.Gomez, G.C.King, J.W.McConkey (Dept. of Phys., Univ. of Windsor, Windsor, Ontario, Canada).
J. Phys. B (GB), vol.16, no.8, p.1481-501 (28 April 1983).
High-resolution metastable excitation function measurements have been made in the doubly excited states region for Ne, Ar and Kr targets. Comparison of the spectra obtained suggests that the gross features are due to negative-ion resonances. Previous techniques which have proved successful in the identification and classification of resonances in the rare gases at energies below the first ionisation threshold are applicable in this energy region also and assignments for a number of resonanees are suggested. Where appropriate, comparisons are made with data obtained by other techniques. The modified Rydberg formula has been used to predict energies for both doubly and triply excited configurations. (31 refs.)

65900 **Prolate-spheroidal semiempirical model for some monoexcited states Π_g and Δ_g of Na_2.** A.Alikacem, M.Aubert-Frecon (Lab. de Spectrometrie Ionique et Moleculaire, Univ. Lyon I, Villeurbanne, France).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.343-52 (Feb. 1983).
Values of the energy for the $nd\Pi_g$ ($n\in\{3, 39\}$) and $nd\Delta_g$ ($n\in\{3, 46\}$) Rydberg series of Na_2 were computed in a semiempirical way from multipolar expansions, the parameters of which were fitted from the experimental data of Carlson et al. (1981) corresponding to rather small values of n. The spherical multipolar expansion is found to be inadequate to describe Rydberg states of Na_2 while the prolate-spheroidal formalism is satisfactory. Results obtained from the spheroidal model for larger values of n are in fairly good agreement with the recent experimental data of Martin et al. (1982). (12 refs.)

65901 **Rydberg states with a $^2\Pi$ core: the $b^3\Pi_i$ and $C^2\Pi$ states of DCl.** K.P.Huber, F.Alberti (Herzberg Inst. of Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.387-404 (Feb. 1983).
The rotational structure in the lowest Rydberg complex of hydrogen chloride, $[X^2\Pi]4s\sigma$, was reinvestigated. The study is limited to the spectrum of $D^{35}Cl$, the HCl bands being too diffuse for a detailed analysis of second-order effects. The Λ-type doubling in both component states, $b^3\Pi$, and $C^1\Pi$, is small since it arises from the uncoupling of the core rather than Rydberg orbital angular momentum. It can be interpreted in terms of pure precession relations that are known to exist between the ground and first excited states of DCl^+. By contrast, the spin-orbit interactions, also originating in the core, are strong. In addition to distorting the triplet splitting in $b^3\Pi$, they lead to an avoided crossing between the nearly coinciding levels $b^3\Pi_0$ ($\nu=1$) and $C^1\Pi_1$ ($\nu=0$). They are also responsible for anomalies in the $b^3\Pi_0 \leftarrow X^1\Sigma^+$ R-branch intensities of DCl as well as of HBr, DBr, and HI. From the J values at the observed R-branch minima the authors have estimated the ratio $\mu_\parallel/\mu_\perp$ of the transition moments associated with the excitation of a $3p\sigma$ or $3p\pi$ core electron to the $4s\sigma$ Rydberg orbital of DCl and, correspondingly, of the other hydrogen halides. (22 refs.)

65902 **Formation and destruction of the $O_2(b^1\Sigma_g{}^+)$ metastable state in the positive column of a glow discharge in oxygen.** A.I.Maksimov, V.V.Rybkin.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.756-60 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.33-8 (July 1982). [received: March 1983]
Systematic measurements have been made of the metastable-molecule concentrations, and the formation and destruction mechanisms determined for various discharge parameters. Data is presented for $O_2(b^1\Sigma_g{}^+)$. The measurements were made in a discharge tube of molybdenum glass with electrodes in side arms. The radiation was recorded in the wavelength range 200-850 nm for the radiation emerging from the axial zone (diameter 2 mm) in the positive column PC from the end of the tube. (28 refs.)

65903 **Two-channel MODT analysis of bound $5snd^3D_{1/3}$ Rydberg states of strontium.** R.Beigang, D.Schmidt (Inst. fur Atom- und Festkorperphys., Freie Univ. Berlin, Berlin, Germany).
Phys. Scr. (Sweden), vol.27, no.3, p.172-4 (March 1983).
The $5snd$ $^3D_1$ and $^3D_3$ series of Sr are analysed by means of multichannel quantum defect theory for principal quantum numbers $n>12$. With a two-channel analysis using the $4d6s$ $^3D_1$ and $^3D_3$ character into the two $5snd$ $J=1$ and $J=3$ series is determined. (8 refs.)

65904 **Multichannel quantum defect analysis of the autoionized even-parity spectrum of neutral barium below the $5d^2D_{3/2}$ limit.** M.Aymar, P.Camus, A.El Himdy (Lab. Aime Cotton, CNRS II, Orsay, France).
Phys. Scr. (Sweden), vol.27, no.3, p.183-91 (March 1983).
Extensive new data on the even-parity autoionized spectrum of Ba has been provided by two-step optogalvanic spectroscopy. The spectral range below the $5d_{3/2}$ ionization limit presents a complicated scheme of interacting levels, which is analyzed using the multichannel quantum defect theory (MQDT). The analysis concerns the $5d_{3/2}n\ d$ and $5d_{3/2}ns$ series converging on the $5d_{3/2}$ limit and their perturbers belonging to $5d_{5/2}nd$ and $5d_{5/2}ns$ series converging on the higher $5d_{5/2}$ limit. This is a favourable case for MQDT since the number of perturbing levels is very large: for each $5d_{5/2}nl$ perturbing series, nine levels are located below the $5d_{3/2}$ limit. A J by J treatment of the energies of the spectra with J value ranging from 0 to 5 was carried out taking into account the $5dnd$-$5dns$ mixing. The analyses only concern the position of autoionized levels. In fact the $5dnl$ autoionized lines observed in this range are relatively narrow and one can neglect the coupling of $5dnl$ levels with $6s\epsilon l$ continua. The MQDT treatments presented here allow us to improve the identification of levels and to describe accurately the behaviour of perturbed series. (20 refs.)

65905 **A method for the determination of the inter-charge distance in the doubly-charged ions.** S.Cuna, C.Cuna (Inst. de Tehnol. Izotopica si Moleculara, Cluj-Napoca, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.10, p.982-5 (1982). In Rumanian.
The charge-separation reactions of the doubly charged ions can be detected from the metastable peaks resulting from the fragmentations occurring in the field-free regions of a double-focusing mass spectrometer. The coulombic energy gained on separating the charges from their distance in the activated complex to infinity will be $e^2/R=T$ or in common units $T(\mathrm{eV})=14.39/R(\text{Å})$. The calculated intercharge distance helps the authors to define the geometry of the transition state. (4 refs.)

A simple model of a Feshbach resonance ... See Entry 64627

Transitions in multiply excited F VI and F VII ... See Entry 65917

Separation of time-averaged turbulence components by laser-induced fluorescence ... See Entry 65920

Probabilities for electric quadrupole transitions between Rydberg states of atoms and ions ... See Entry 65930

Recent developments in photoelectron dynamics using synchrotron radiation ... See Entry 65931

He^- photodetachment: effects of the $1s2p2p'^4P^e$ resonance ... See Entry 65935

Stochastic ionization of excited atomic hydrogen in an electromagnetic-wave field ... See Entry 65940

On the time variable in the description of molecular systems: from molecular transients to biomolecules ... See Entry 65943

Millimeter-wave spectrum of ethyl acetylene centrifugal distortion, Coriolis interaction and internal rotation ... See Entry 65968

Infrared linear dichroism of the T_1 state of acridine in stretched polyethylene ... See Entry 65971

Electronic absorption and emission studies of the Group IIIA metal suboxides isolated in cryogenic rare gas matrices ... See Entry 66000

Two-photon absorption study of Zn(II)tetraphenylporphin: role of a higher excited singlet state of gerade symmetry ... See Entry 66005

UV absorption spectra of vibrationally highly excited toluene molecules ... See Entry 66007

Variation of dipole moments with triplet state energy spacings in substituted benzaldehydes ... See Entry 66047

Lowest excited singlet state of hydrogen-bonded methyl salicylate ... See Entry 66051

Spectral-kinetic properties of the delayed fluorescence of complex molecules with inhomogeneously broadened energy levels ... See Entry 66063

Vibrational relaxation and dissociation of strongly excited ozone molecules ... See Entry 66082

Intermolecular attractive forces in triplet excimers: *L*-shaped excimer of naphthalene ... See Entry 66090

Ion-atom collision-induced absorption ... See Entry 66099

Using nuclear resonance excitation to observe united atoms in symmetric ion-atom collisions ... See Entry 66110

Lifetimes and fluorescence yields of states produced in heavy ion-atom collisions ... See Entry 66111

Radiative decay of lithium-like ions following charge exchange collisions of 3 keV amu^{-1} C^{4+} ions with H_2 ... See Entry 66114

Electron capture into excited states in collisions of highly charged ions with atoms: a theoretical and experimental challenge ... See Entry 66123

Electron capture into excited states of hydrogen ... See Entry 66127

Resonant and nonresonant electron scattering in an inhomogeneous laser field ... See Entry 66141

Nonlinear fast-beam laser interactions ... See Entry 66150

Lasing characteristics of deoxygenated solutions of laser dyes ... See Entry 66265

Theoretical and experimental investigation of electronically excited states, luminescence properties, and lasing capability of pyrene and its phenylethynyl derivatives ... See Entry 66266

Radial density distribution of excited atoms in a surface-wave-produced Ar-O_2 plasma column ... See Entry 66751

Electronic energy partitioning in reactions occurring on more than one potential energy surface: metastable $Mg(^3P)$ atoms with halogen molecules ... See Entry 68771

Single and triplet energy surfaces of NiH_2 ... See Entry 68773

31.70 EFFECTS OF MOLECULAR INTERACTIONS ON ELECTRONIC STRUCTURE

(see also 34. Atomic and molecular collision processes and interactions)

31.70D Environmental and solvent effects

65906 Bond orbital framework for rapid calculation of environmental effects on molecular potential surfaces. G.Naray-Szabo, P.R.Surjan (CHINOIN Pharmaceutical & Chem. Works, Budapest, Hungary).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.499-501 (15 April 1983).
A procedure is outlined to calculate rapidly potential surfaces of very large (bio)molecules. Using strictly localized orbitals as a basis set, the molecule is divided into a central part, treated at the SCF level, and the environment where the strictly localized character of the orbitals is maintained. Conformation of the active serine sidechain in α-chymotrypsin is discussed. (19 refs.)

65907 Solvent effect on the correlation between dipole increment and complexation enthalpy in charge transfer complexes. P.Huyskens, Ph.Mahillon, F.Kapuku (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium).
J. Mol. Liq. (Netherlands), vol.25, no.1, p.13-24 (March 1983).
The dipole moments μ_{AB} and the complexation enthalpies $-\Delta H_{ab}$ of a series of complexes between iodine and substituted pyridines were determined in CCl_4 and in C_6H_6 at 298.16K. Within the limits of experimental errors the moments are the same in CCL_4 as in cyclohexane, whereas in benzene they are systematically larger by 0.48 ± 0.04 Debye. The transfer enthalpies of the complexes from cyclohexane towards CCl_4 are of the order of -5.9 ± 1.0 $kJmole^{-1}$ but reach $4\text{-}10.4 \pm 1.0$ $kJmole^{-1}$ from cyclohexane towards C_6H_6. A part of the stabilization is due to the increase of the dielectric constant. For benzene however the major part can be ascribed to specific interaction between the solvent molecules and the π-electrons of pyridine-iodine complexes. (15 refs.)

65908 A dielectric model for the solvent effect on the intensity of light absorption. T.Shibuya (Dept. of Chem., Shinshu Univ., Nagano, Japan).
J. Chem. Phys. (USA), vol.78, no.8, p.5175-82 (15 April 1983).
A new dielectric model is proposed for the solvent effect on the absorption intensity. The ratio of the apparent oscillator strength f'' of a solute molecule measured in a solution of refractive index n to the oscillator strength f of the solute molecule is given by $f''/f=[s(n^2-1)+1]^2/n$, where s is a 'shape' parameter of the cavity in which the solute molecule is supposed to lie. The parameter s is identified with the depolarization factor of a dielectric in the same shape as the cavity, for the direction of the transition moment. The proposed linear relation betwen $(nf'')^{1/2}$ and n^2-1 is demonstrated for the $\pi \rightarrow \pi^*$ transition of β-carotene and for the $n \rightarrow \pi^*$ transition of pyrazine. For the allowed $\pi \rightarrow \pi^*$ transitions of long linear polyenes, the s value is approximately 0, leading to the relation $f''/f=1/n$. The proposed formula also reduces to the well-known Chako formula $f''/f=(n^2+2)^2/(9n)$ for the spherical cavity whose s value is 1/3. The theory predicts that $1/n \leq f''/f \leq n^3$. It is shown that the proposed formulas are also derivable from Scholte's expressions (1949) of the cavity field and the reaction field for ellipsoidal cavity. (63 refs.)

65909 Dynamics of the spectra of solvating systems. L.D.Zusman, A.B.Gelman.
Opt. & Spectrosc. (USA), vol.53, no.3, p.248-52 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.421-8 (Sept. 1982). [received: May 1983]
A general quantum theory of the spectra of solvating systems, i.e. systems whose initial state is not an equilibrium state with respect to the polarization of the medium, is constructed. A general expression is obtained for the spectrum, expressed in terms of integrals of the complex permittivity of the solvent. It is shown that in the case of strong coupling with the medium, the spectrum evolves without change of form to its stationary situation, and the law of this evolution repeats the time dependence of the classical correlation function of the random process of the fluctuations in the medium polarization. (14 refs.)

Solvent dependence of deuteron quadrupole coupling constants and of methyl angles of some CD_3X compounds determined by NMR of partially oriented molecules .... See Entry 66018

Nuclear magnetic resonance studies of transition-metal complexes of ethylenediaminetetra-acetic acid (EDTA) in aqueous solution .... See Entry 66029

^{31}P NMR study of the inclusion of organophosphorus molecules in cyclodextrins .... See Entry 66030

Picosecond fluorescence decay kinetics of crystal violet in low-viscosity solvents .... See Entry 66044

Photophysical properties of benzimidazole and thiabendazole and their homologues. Effect of substituents and solvent on the nature of the transition .... See Entry 66048

A theoretical study of the solvent effect on dissociation reactions. The role of the first solvation shell .... See Entry 68760

31.70F Potential-energy surfaces for collisions

(see also 82.20K in chemical kinetics, 34.20 Intermolecular forces, 34.50L in beam studies)

65910 Potential energy curves and dissociation energy of monochlorides of beryllium magnesium and calcium. M.P.Varma, N.B.Ishwar, B.L.Jha (Dept. of Phys. and Math., Indian School of Mines, Dhanbad, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.828-9 (Oct. 1982). [received: April 1983]
The RKRV potential energy curves for the observed electronic states of gaseous monochlorides of beryllium, magnesium and calcium have been constructed using the method of Y B Rao and P Venkateswarlu [J Mol Spectrosc. (USA), 9 (1962), 173]. The ground state dissociation energy of these molecules has been evaluated by curve fitting technique. (14 refs.)

On the basis set superposition error in potential surface investigations. I. Hydrogen-bonded complexes with standard basis set functions .... See Entry 65866

Accurate ab initio potential curves using bond functions .... See Entry 65871

CASSCF/CI calculations for first row transition metal hydrides: The $TiH(^4\Phi)$, $VH(^5\Delta)$, $CrH(^6\Sigma^+)$, $MnH(^7\Sigma^+)$, $FeH(^{4,6}\Delta)$, and $NiH(^2\Delta)$ states .... See Entry 65892

Bond orbital framework for rapid calculation of environmental effects on molecular potential surfaces .... See Entry 65906

High-resolution Fourier spectrometry of $^{14}N_2$ infrared emission spectrum: extensive analysis of the $B^3\Pi_g$-$A^3\Sigma_u^+$ system .... See Entry 65978

Constant of the second O_g^+ ion-pair state of I_2 .... See Entry 66093

Comment on 'recent determinations of potassium ion-rare gas potentials' .... See Entry 66096

31.70H Time-dependent phenomena: excitation and relaxation processes, and reaction rates

(see also 34. Atomic and molecular collisions)

Lowest excited singlet state of hydrogen-bonded methyl salicylate .... See Entry 66051

31.90 OTHER TOPICS IN THE THEORY OF ATOMS AND MOLECULES

(inc. properties other than energy)

65911 Electronic properties of alkali trimers. J.L.Martins (Inst. de Phys. Experimentale, Ecole Polytech. Federale, Lausanne, Switzerland), R.Car, J.Buttet.
J. Chem. Phys. (USA), vol.78, no.9, p.5646-55 (1 May 1983).
The electronic properties of the alkali trimers Li_3, Na_3, and K_3 are studied using the pseudopotential and the local-spin-density approximations. More than 100 configurations were calculated for each trimer in order to obtain a complete picture of the adiabatic Born-Oppenheimer surfaces. The equilibrium geometry of the trimers are Jahn-Teller distortions of an equilateral triangle. Although the three surfaces are quite similar, Li_3 is more affected than Na_3 or K_3 by the dynamical character of the Jahn-Teller distortion. The calculated ionization potentials agree very well with the experimental values and the qualitative features of the Born-Oppenheimer surface are confirmed by recent ESR experiments. (45 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ... See Entry 64573

The valence-bond self-consistent field method (VB-SCF): theory and test calculations .... See Entry 65853

Theoretical study of electrolytic ring opening of oxirane .... See Entry 65886

Rotational analysis and deperturbation of the $C^2\Sigma^+$-$X^2\Sigma^+$ band systems of BeH and BeD .... See Entry 65944

The He-O_2 anisotropic van der Waals potential from the interplay of theory and scattering experiments .... See Entry 66091

Single and triplet energy surfaces of NiH_2 .... See Entry 68773

32.00 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

32.20 ATOMIC SPECTRA GROUPED BY WAVELENGTH RANGES

65912 On the 'giant resonance' in the 4d spectra of Ba, Ba^+ and Ba^{2+}. J.P.Connerade (Blackett Lab., Imperial Coll., London, England).
J. Phys. B (GB), vol.16, no.9, p.L257-62 (14 May 1983).
A new and detailed interpretation of the discrete structure in the Ba^{2+} spectrum based on a standard application of quantum defect theory (QDT) is presented, and the method is shown to yield realistic relative intensities in the discrete spectrum. It is argued that any collective oscillations are damped within one period and can give rise to no harmonics, while any ab initio theory capable of prediction the giant resonance in the continuum correctly is also suitable for the discrete structure. (12 refs.)

65913 Double excitation in the K absorption spectrum of neon. J.M.Esteva, B.Gauthe, P.Dhez, R.C.Karnatak (LURE, Univ. de Paris-Sud, Orsay, France).
J. Phys. B (GB), vol.16, no.9, p.L263-8 (14 May 1983).
The high resolution spectrum of gaseous neon in the 1s region was obtained by using synchrotron radiation. In addition to previously observed single-electron excitation lines, the authors observed two new sharp lines of comparable intensities in the continuum at 35.1 and 38.1 eV above the 1s→3p resonance line. On the basis of the known Ne 1s XPS shake-up lines the authors attribute them to transitions to $^1P^0$ levels of the $1s2s^22P^53p^2$ final-state configuration. (19 refs.)

65914 High Rydberg transitions in the principal and intercombination series of mercury. M.A.Baig (Phys. Inst., Univ. Bonn, Bonn, Germany).
J. Phys. B (GB), vol.16, no.9, p.1511-23 (14 May 1983).
The aborption spectrum of mercury vapour has been recorded at high resolution (± 0.003 Å) in the 1150-1350 Å region with synchrotron radiation as the background source of the continuum. Observations comprise the principal series: $6s^2\ ^1S_0 \rightarrow 6snp\ ^1P_1^0$ $(8<n \leq 37)$ and the intercombination series: $6s^2\ ^1S_0 \rightarrow 6snp\ ^3P_1^0$ $(8<n \leq 48)$. An intensity anomaly occurs at high n values with $^3P_1^0$ gaining most of the oscillator strength at the expense of the $^1P_1^0$ transitions. Simple intermediate coupling calculations show that this is due to a change from *LS* to *jj* coupling with increasing n values. A two-dimensional Lu-Fano plot it is also presented and this exhibits interchannel interactions between the $^1P_1^0$ channels. As a result of the new measurements, the previously somewhat uncertain determination of the first ionisation potential is reliably confirmed as 84184.10 ± 0.20 cm^{-1}. (36 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ... See Entry 64573

Multichannel quantum defect analysis of the autoionized even-parity spectrum of neutral barium below the $5d^2D_{3/2}$ limit .... See Entry 65904

Ion-atom collision-induced absorption .... See Entry 66099

Line ratios for O VII .... See Entry 69494

32.20J Visible and ultraviolet spectra

(for fluorescence and phosphorescence spectra, see 32.50)

65915 S II and S III branching ratios in the 600- to 1200-Å interval. M.D.Morrison, A.J.Cunningham (Center for Space Sci., Univ. of Texas, Richardson, TX, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3233-6 (1 April 1983).
Branching ratios of singly and doubly ionized sulfur EUV emissions are presented. The S II transitions originated from the ^2P, $4s'\ ^2D$, and $4s\ ^2P$ terms and terminated on the metastable states of the ion. The S III transitions originated from the $3d\ ^3D^0$, $4s\ ^3P^0$, $3p^3\ ^3S^0$, $4s\ ^1P^0$, and $3s3p^3\ ^1P^0$ terms and terminated on the metastable and ground ionic states. The results for S III include branching ratios involving intercombination transition which impact ongoing modeling of the energy budget of the Io plasma torus. (16 refs.)

65916 The quartet system of Li I. S.Mannervik, H.Cederquist (Res. Inst. of Phys., Stockholm, Sweden).
Phys. Scr. (Sweden), vol.27, no.3, p.175-82 (March 1983).
The doubly-excited system of quartets in Li I have been studied by the beam-foil technique using optical detection in the VUV. The absolute term value of the lowester quartet $1s2s2p\ ^4P^0$ has been determined to be 57.4113 ± 0.0006 eV which is much more accurate than earlier experimental results. The authors have also made the first experimental determination of the term energy of the $1s2p3p\ ^4P$ state by observing its decay to the $1s2s2p\ ^4P^0$ state by emission of a spectral line at 1680.2 Å. In addition, eight new observations of quartet transitions are reported as well as some lifetimes. The most recent experimental results are summarized and compared to calculations. (62 refs.)

65917 Transitions in multiply excited F VI and F VII. I.Martinson, B.Denne, J.O.Ekberg, L.Engstrom, S.Huldt, C.Jupen, U.Litzen (Dept. of Phys., Univ. of Lund, Lund, Sweden), S.Mannervik, A.Trigueiros.
Phys. Scr. (Sweden), vol.27, no.3, p.201-6 (March 1983).
The transitions $1s2s2p^2\ ^5P$-$1s2p^{3 5}S^0$ in F VI and $1s2s2p^4P^0$-$1s2p^2\ ^4P$ in F VII have been investigated using the method of beam-foil spectroscopy. The fine-structure separations have been determined for the $1s2s2p^2\ ^5P$ term in F VI and for both ^4P terms in F VII. The results are compared with recent theoretical calculations of fine structure, based on relativistic wavefunctions, and with previous experimental data. Lifetime measurements are reported for the $1s2p^2\ ^4P_{5/2}$ level and $1s2p^3\ ^5S_2{}^0$ level. (35 refs.)

Measurement of electron-impact excitation cross section of the germanium atom .... See Entry 66144

32.20R X-ray spectra

Theoretical lifetimes, X-ray transition energies and fluorescence yields for double K vacancy configurations of multiply-ionized fluorine .. See Entry 65918

Theoretical X-ray transition energies and fluorescence yields for multiply-ionized oxygen .... See Entry 65919

L X-ray anisotropy and L_3-subshell alignment of heavy atoms induced by ion impact .... See Entry 66116

K and L X-ray excitation in very-heavy-ion-atom collisions near K-L level matching .... See Entry 66118

Principal and dielectronic satellite line spectra for Ca XIX: SMM observations .... See Entry 69571

32.50 FLUORESCENCE, PHOSPHORESCENCE

(inc. quenching)

65918 Theoretical lifetimes, X-ray transition energies and fluorescence yields for double K vacancy configurations of multiply-ionized fluorine. C.Can, C.P.Bhalla (Dept. of Phys., Kansas State Univ., Manhattan, KS, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1090-2 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Theoretical X-ray transition energies, lifetimes, partial multiplet fluorescence yields and average fluorescence yields have been calculated for various fluorine ions with a double K-shell vacancy. (4 refs.)

65919 Theoretical X-ray transition energies and fluorescence yields for multiply-ionized oxygen. C.P.Bhalla (Dept. of Phys., Kansas State Univ., Manhattan, KS, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1097-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Theoretical X-ray transition energies and multiplet partial fluorescence yields are presented for various oxygen ions with a single K-shell vacancy. (3 refs.)

65920 Separation of time-averaged turbulence components by laser-induced fluorescence. S.Cheng, M.Zimmermann, R.B.Miles (Dept. of Mech. & Aerospace Engng., Princeton Univ., Princeton, NJ, USA).
Phys. Fluids (USA), vol.26, no.4, p.874-7 (April 1983).
Turbulence is measured by resonant fluorescence of sodium atoms seeded into a supersonic nitrogen jet. By varying the frequency of the pumping laser, the mean square velocity, temperature, and pressure fluctuations (as well as their correlations) may be determined. (10 refs.)

S II and S III branching ratios in the 600- to 1200-Å interval .... See Entry 65915

A multichannel theory of inverse two-electron recombination .. See Entry 65934

Two-photon laser-induced fluorescence studies of HS radicals, DS radicals, and I atoms .... See Entry 66042

Fe emission yield and photoionization of Fe(CO)$_5$ by vacuum-ultraviolet radiation .... See Entry 66079

Lifetimes and fluorescence yields of states produced in heavy ion-atom collisions .... See Entry 66111

Radiative decay of lithium-like ions following charge exchange collisions of 3 keV amu^{-1} C^{4+} ions with H$_2$ .... See Entry 66114

L X-ray anisotropy and L_3-subshell alignment of heavy atoms induced by ion impact .... See Entry 66116

K and L X-ray excitation in very-heavy-ion-atom collisions near K-L level matching .... See Entry 66118

Sidebands in cooperative resonance fluorescence in collections of *N* three-level atoms in strong excitation laser fields .... See Entry 66246

Spatially resolved temperature measurements in a flame using laser-excited two-line automatic fluorescence and diode-array detection ...... See Entry 68778

32.60 ZEEMAN AND STARK EFFECTS

65921 Stark shift trends in homologous ions. I.S.Lakicevic (Inst. of Phys., Belgrade, Yugoslavia), J.Puric.
J. Phys. B (GB), vol.16, no.9, p.1525-30 (14 May 1983).
The Stark shifts of Pb II, P II, Sn II and Sb II non-resonance lines have been measured in an electromagnetic T-tube plasma. The electron temperature was varied in a range from 16000 to 20000K and the electron number density from 0.3×10^{23} to 1.4×10^{23} m^{-3}. On the basis of the some established Stark shift regularities and systematic trends, predictions for the same lines were made. The experimental data and complete data set obtained in this way were used to demonstrate the existence of the other types of common regularities for the lines originating from the same type of transition. (10 refs.)

65922 Complex scaling of AC Stark Hamiltonians. J.S.Howland (Dept. of Math., Univ. of Virginia, Charlottesville, VA, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1240-4 (May 1983).
For a two-body atom in a temporally periodic, spatially uniform field, it is shown that in an appropriate gauge the essential spectrum of the Floquet Hamiltonian rotates about a certain set of thresholds when subjected to a complex scaling transformation. (7 refs.)

65923 Observation and quasistatic analysis of structure in microwave ionization of highly excited helium atoms. D.R.Mariani (J.W. Gibbs Lab., Yale Univ., New Haven, CT, USA), W.van de Water, P.M.Koch, T.Bergeman.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1261-4 (25 April 1983).
The ionization of He$[1s(n \simeq 30)s]^3S_1$ atoms by an oscillating electric field (9.92 GHz) is strongly dependent on the field amplitude. The ionization curves reveal structures which are absent in those for H($n \simeq 30$) atoms. The ionization rate does not increase monotonically near threshold and is approximately constant over one or more regions of higher field. A quasistatic model is considered which relates the structure in the ionization curves of He to the occurrence of anticrossings in He Stark states. (16 refs.)

32.70 SPECTRAL LINE SHAPES AND INTENSITIES

65924 Comprehensive theory for line broadening in high-resolution and nonlinear spectroscopies: application to the Na D lines. R.M.Herman, E.W.Weber (Phys. Inst. der Univ. Heidelberg, Heidelberg, Germany).
J. Phys. B (GB), vol.16, no.8, p.1323-41 (28 April 1983).
A general method for analysing line broadening caused by Doppler, phase-shift, inelastic and velocity-changing collisional effects is proposed for transitions at optical wavelengths. In a unified approach Poisson statistics are used to describe collision probabilities randomly distributed in a time interval which can terminate the optical coherence in a combination of the above effects; markoffian independence is assumed for each collision. Then the dipole moment correlation function is obtained in a form which is virtually exact in accounting for all effects of isotropic forces, and which is correct to second-order terms in the anisotropic interaction potentials. Phenomena as diverse as standard optical pressure broadening, broadening due to velocity-changing collisions in nonlinear spectroscopies, and Dicke narrowing of the Doppler contour are described. The implications of the theory are discussed in detail and applied to the case of the NaD lines perturbed by He buffer gas. Numerical calculations reveal that the substantially different lineshift and broadening parameters in nonlinear and in standard optical spectroscopies can be reasonably well understood within the limitations posed by present uncertainties in the Na 3^2P-He interaction potentials. However, the large differences in shift and width between the D$_2$ and D$_1$ lines in saturation spectroscopy cannot be explained within the present theory. (34 refs.)

65925 Effects of radiative decay on electron-ion cross sections below and above an excitation threshold. H.van Regemorter (Obs. de Paris-Meudon, Meudon, France).
J. Phys. B (GB), vol.16, no.9, p.L289-94 (14 May 1983).
When radiative decay competes with autoionisation, below an excitation threshold, the resonance contribution to excitation in highly-charged ions can be considerably reduced. Just above threshold, radiative decay of the ion may also occur before excitation, and the excitation cross section is reduced. The importance of this effect is studied in the case of resonance transitions in helium-like ions. (8 refs.)

65926 Moderately accurate oscillator strengths from NBS intensities. II. C.R.Cowley (Dept. of Astron., Univ. of Michigan, Ann Arbor, MI, USA), C.H.Corliss.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.651-9 (May 1983).
For pt.I see ibid., vol.202, no.2, p.417-25 (1983). Cowley (1983) explored the calibration of NBS Monograph 145 intensity measurements for the purpose of obtaining useful oscillator strengths. The authors investigate the question of a single 'temperature' for the copper arc light sources. Statistical arguments support rejection of the null hypothesis of a single temperature. Evidence is found for a mild correction to the intensity scale, but there is no indication that the intensities drift with wavelength. The authors reinforce earlier findings that very useful *gf*-values can be derived from Monograph 145 intensities for any spectrum in which there are enough accurate measurements for a calibration. A table lists interpolation coefficients for Fe I, Co I, Ni I, Ti I, Zr II, Y II, Nd II and U II. An improved formula is given to transform the Corliss-Tech (1968) Fe I oscillator strengths to the Oxford system. (29 refs.)

65927 Iodine configurations $5p^4ns$, $5p^4np$ (n=6,7). Radiative transition probabilities, radiative lifetimes. A.V.Loginov, P.Z.Gruzdev.
Opt. & Spectrosc. (USA), vol.53, no.3, p.237-9 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.400-4 (Sept. 1982). [received: May 1983]
Values of the $5p^4np$-$5p^4ns$ and $5p^4ns$-$5p^5$ transition probabilities and the radiative lifetimes for the $5p^4ns$ and $5p^4np$ (n=6, 7) levels for the iodine atom are obtained in the intermediate-coupling scheme with electrostatic, spin-orbit, and effective interactions taken into account. (12 refs.)

65928 Determination of radiative lifetimes of lower resonance states for atoms of the copper subgroup (Cu I, Ag I, Au I). N.N.Bezuglov, V.N.Gorshkov, A.L.Osherovich, G.L.Phekhotkina.
Opt. & Spectrosc. (USA), vol.53, no.3, p.239-42 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.405-10 (Sept. 1982). [received: May 1983]
The lifetimes of six lower resonance levels of Cu I, Ag I, and Au I are measured with the proper correction for the effect of radiation capture in the finite volume of the directed beam. The results are compared with the radiative lifetimes under conditions of almost complete absence of radiation capture. (14 refs.)

65929 Probabilities for transitions between levels of two-electron ions in a constant electric field. G.L.Klimchitskaya, M.E.Konyzhev.

Opt. & Spectrosc. (USA), vol.53, no.3, p.318-19 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.541-3 (Sept. 1982). [received: May 1983]

The authors are interested in the effect of a uniform constant electric field on the transition probabilities in multiply charged two-electron ions. The Coulomb interaction of the electrons mixes states with different values of $j_1l_1j_2l_2$, while the interaction with the external field mixes states with different values of J. In calculation of the mixing coefficients it is sufficient to consider only the Coulomb interaction of the electrons. External fields are considered for which the energy of the electron-field interaction can be large in comparison with the energy of the electron-electron interaction but still much smaller than the binding energy in a multiply charged ion. (12 refs.)

65930 Probabilities for electric quadrupole transitions between Rydberg states of atoms and ions. V.A.Davydkin, A.Yu.Makerenko.

Opt. & Spectrosc. (USA), vol.53, no.3, p.327-8 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.553-7 (Sept. 1982). [received: May 1983]

The semiclassical approximation in the quantum defect method (the WKBJ-QD approximation) is used to derive analytic expressions for the probabilities for electric quadrupole transitions between highly excited Rydberg states of atoms and ions. (5 refs.)

High Rydberg transitions in the principal and intercombination series of mercury ....See Entry 65914

The quartet system of Li I ....See Entry 65916

Theoretical lifetimes, X-ray transition energies and fluorescence yields for double K vacancy configurations of multiply-ionized fluorine ..See Entry 65918

Stark shift trends in homologous ions ....See Entry 65921

Lifetimes and fluorescence yields of states produced in heavy ion-atom collisions ....See Entry 66111

Fast beam radiofrequency spectroscopy ....See Entry 66149

Nonlinear fast-beam laser interactions ....See Entry 66150

Gas laser with a phase anisotropy in an axial magnetic field for arbitrary relative excitation of the active medium ....See Entry 66251

32.80 PHOTON INTERACTIONS WITH ATOMS

65931 Recent developments in photoelectron dynamics using synchrotron radiation. T.A.Carlson, M.O.Krause (Oak Ridge Nat. Lab., Oak Ridge, TN, USA), J.W.Taylor, P.R.Keller, M.N.Piancastelli, F.A.Grimm, T.A.Whitley.

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1034-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

Through a collaborative effort of members of the Oak Ridge National Laboratory and Universities of Wisconsin and Tennessee, a comprehensive study of atoms and molecules using angle-resolved photoelectron spectroscopy and synchrotron radiation is underway at the Synchrotron Radiation Center, Stoughton, Wisconsin. Over 50 molecules and atoms have been investigated. These results, coupled with theory, aim at a better understanding of the dynamics of photoionization and of the wave functions that control these processes. In particular, attention is given to the following topics: metal atomic vapors, generalization of molecular orbital types, autoionization, shape resonances, core shell effects, satellite structure and the Cooper minimum. (33 refs.)

65932 Overlap of He atom and He$^+$ ground-state wave functions and calculation of ionization potential. K.Dawson, N.H.March (Theoretical Chem. Dept., Univ. of Oxford, Oxford, England).

Phys. Lett. A (Netherlands), vol.94A, no.9, p.434-6 (4 April 1983).

The one-body equation proposed earlier (see March, ibid., vol.84, p.319, 1981) for determining the overlap of He atom and He$^+$ wave functions can be given a fundamental justification. This equation with an approximate form of one-body potential can be solved, and an excellent ionization potential results. The helium atom ground-state wave function can thereby be refined. (6 refs.)

Comment on 'How can a particle absorb more than the light incident on it?' ....See Entry 64612

32.80B Level crossing and optical pumping

Observation and quasistatic analysis of structure in microwave ionization of highly excited helium atoms ....See Entry 65923

32.80D Autoionization

65933 Theoretical autoionisation rates of the 1s2p^2 ^{2}D and 1s2s2p ^{2}P^0 states of Li. C.A.Nicolaides, G.Aspromallis (Theoretical & Phys. Chem. Inst., Nat. Hellenic Res. Found., Athens, Greece).

J. Phys. B (GB), vol.16, no.9, p.L251-5 (14 May 1983).

By applying a many-electron approach to the calculation of autoionising states, which takes electron correlation and non-orthonormality into account, the authors have obtained the autoionisation rates of the Li 1s2p^2 ^{2}D and [1s(2s2p) ^{3}P^0] ^{2}P^0 states as 15.2×10^{12} s^{-1} for ^{2}D and 5.2×10^{12} s^{-1} for ^{2}P^0. Contrary to previous theory, these results agree with the recent experimental values of Cederquist and Mannervik (1982) which are $15.8\pm0.4\times10^{12}$ s^{-1} for ^{2}D and $4.0\pm0.2\times10^{12}$ s^{-1} for ^{2}P^0. (18 refs.)

Multichannel quantum defect analysis of the autoionized even-parity spectrum of neutral barium below the $5d^2D_{3/2}$ limit ....See Entry 65904

Excitation of the lowest-lying autoionising level in Cs I ....See Entry 66142

32.80F Photoionization and photodetachment

65934 A multichannel theory of inverse two-electron recombination. Li Jia-ming (Inst. of Phys., Acad. Sinica, Peking, China).

Acta Phys. Sin. (China), vol.32, no.1, p.84-91 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*

The author proposes a multichannel theory on inverse two-electron recombination processes (i.e., inverse resonance radiative-recombination processes). As a specific example, he analyzes the recent high-resolution laser spectroscopic measurements on excited barium atoms by Safinya and Gallagher (1979), illustrating that accurate experimental spectroscopic data can be utilized to assess the accuracy of theoretical calculations on inverse two-electron recombinations. Through the detailed balance relation, it is equivalent to assess the accuracy of theoretical calculations on two-electron recombination processes—this will be a more basic test on theoretical results for each appropriate symmetric block in partial-wave expansions. (20 refs.)

65935 He$^-$ photodetachment: effects of the 1s2p2p$'^4$P^e resonance. J.R.Peterson, M.J.Coggiola, Y.K.Bae (SRI Internat., Menlo Park, CA, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1043-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

He$^-$ exists in a metastable state, (1s2s2p)^{4}P^o, lying 19.74 eV above He(1^{1}S), with substate lifetimes of 10-500 μs. Following a preliminary survey of the photodetachment cross section over a range of energies, the authors have concentrated on a large shape resonance associated with the first excited state of He$^-$, 1s2p2p$'$ ^{4}P^e, which recent calculations have found to lie just above He(2^{3}P). The resonance has a profound effect on the overall photodetachment spectrum. (13 refs.)

65936 Observation of Kr and Xe ions created by intense nanosecond CO$_2$ laser pulses. S.L.Chin, Gy.Farkas, F.Yergeau (Dept. de Phys., Faculte des Sci. et de Genie, Univ. Laval, Laval, Quebec, Canada).

J. Phys. B (GB), vol.16, no.8, p.L223-6 (28 April 1983).

The authors observe that very intense nanosecond CO$_2$ laser pulses ($h\nu=0.117$ eV) do ionise Kr and Xe atoms directly. (4 refs.)

65937 Resonant multiphoton ionisation and third-harmonic generation in mercury vapour. D.Normand, J.Morellec, J.Reif (CENS, Service de Phys. des Atomes et des Surfaces, Gif-sur-Yvette, France).

J. Phys. B (GB), vol.16, no.8, p.L227-32 (28 April 1983).

The interaction of intense dye laser radiation (up to about 100 GW cm^{-2}) with Hg vapour in the pressure region of 10^{15} to 10^{-1} Torr leads to competition between multiphoton ionisation—dominant at low pressure—and third-harmonic generation ($\sim$1850Å) prevailing at high pressure. In particular, third-harmonic generation enhanced by a four-photon resonance is—to the authors' knowledge—reported for the first time. (9 refs.)

65938 Multiply charged ions induced by multiphoton absorption processes in rare-gas atoms at 1.064 μm. A.L'Huillier, L.A.Lompre, G.Mainfray, C.Manus (Service de Phys. des Atomes et des Surfaces, CENS, Gif-sur-Yvette, France).

J. Phys. B (GB), vol.16, no.8, p.1363-81 (28 April 1983).

Multiply charged ions are easily formed in rare gases by multiphoton absorption processes. For Kr and Xe up to quadruply charged ions are formed. They are induced by a bandwidth-limited 50 ps laser pulse at 1.064 W cm^{-2} intensity range. Doubly charged ions are formed through the absorption of a very large number of photons (29 for Xe) in a direct transition from the ground state of the atom to the second ionisation limit. The percentage of Xe^{2+} ions relative to Xe$^+$ ions is 1% at 10^{13} W cm^{-2}, and reaches 20% at 10^{14} W cm^{-2}. At 1.06 μm, the removal of two electrons from the ground state of rare-gas atoms in a single step is responsible for the creation of doubly charged ions. This could be a general rule for atoms which have two or more electrons in the outer shell. (23 refs.)

65939 Calculation of photoionisation cross sections, resonance structure and angular distribution for Mn I by many-body perturbation theory. L.J.Garvin, E.R.Brown, S.L.Carter, H.P.Kelly (Dept. of Phys., Univ. of Virginia, Charlottesville, VA, USA).

J. Phys. B (GB), vol.16, no.9, p.L269-74 (14 May 1983).

Photoionisation cross sections for the 4s, 3d and 3p subshells and the 3d angular distribution have been calculated for atomic Mn by many-body perturbation theory. Spin-orbit effects in the 3p$\rightarrow$3d resonance and resonances due to 3p$\rightarrow$$ns,nd$ ($n>3$) excitations have been computed. Comparison is made with recent experiments. (20 refs.)

65940 Stochastic ionization of excited atomic hydrogen in an electromagnetic-wave field. D.L.Shepelyanskii.

Opt. & Spectrosc. (USA), vol.53, no.2, p.208-9 (Aug. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.2, p.354-6 (Aug. 1982). [received: April 1983]

Conditions are obtained under which stochastic ionization from low-excited states with $n\gtrsim2$ can occur. The condition for the diffusion excitation of atoms is determined by the classical stochasticity limit as well as by the quantum stability limit and is not related with the width $\Delta\omega$ of the electromagnetic radiation spectrum (under the condition that $\Delta\omega\ll\Omega=n^{-3}$). In fact, it follows from the classical discussion, applicable to highly excited levels, that when nonlinear resonances do not overlap and $\Delta\omega\ll\Omega$ the diffusion excitation rate turns out to be exponentially small with respect to the adiabaticity parameter $\Delta\omega/\Omega$. (15 refs.)

Mesurement of photoionisation cross sections for the 7^{2}P$_{3/2}$ and 6^{2}D$_{3/2}$ excited states of caesium ....See Entry 65898

Observation and quasistatic analysis of structure in microwave ionization of highly excited helium atoms ....See Entry 65923

Influence of nonlinear frequency mixing on multiphoton ionization of gases ....See Entry 66667

32.80H Auger effect and inner-shell ionization

65941 Ar L-MM Auger spectra in Ar^{3+}+Ar collisions. T.Matsuo, J.Urakawa, A.Yagishita, Y.Awaya, T.Kambara, M.Kase, H.Kumagai (Inst. of Phys. & Chem. Res., Saitama, Japan).

J. Phys. B (GB), vol.16, no.8, p.L239-42 (28 April 1983).

Energy distributions of electrons ejected in Ar^{3+}+Ar collisions were measured at collision energies of 4.3 and 6.6 MeV. The L-MM Auger peaks from the targets were distributed through 100 to 200 eV. The isolated peaks located at about 101 eV were observed for the first time; they were attributed to the L$_{23}$-M$_1$M$_2$ Auger electrons from the target Ar ions which have six vacancies in the M$_{23}$ shell. (4 refs.)

65942 N$_{4,5}$N$_{6,7}$X Coster-Kronig spectra of free Hg atoms. H.Aksela, S.Aksela (Dept. of Phys., Univ. of Oulu, Oulu, Finland).

J. Phys. B (GB), vol.16, no.9, p.1531-41 (14 May 1983).

The N$_{4,5}$N$_{6,7}$X (X=N$_{6,7}$, O$_{2,3}$, O$_{4,5}$) Coster-Kronig-type Auger spectra of free mercury atoms have been measured and analysed by comparing the experimental results with the calculated profiles. The spectra have been measured with the use of electron beam excitation. The kinetic energies of the Auger lines have been calculated by the ΔSCF method using a relativistic Dirac-Fock program. The relative energies of the line components have also been computed non-relativistically and a comparison has been made between the non-relativistic and the relativistic results. The intensities of the lines have been calculated in the mixed coupling scheme applying *jj* coupling to the initial states and intermediate coupling to the final states. The calculated profile reproduces the fine structure in the experimental spectrum rather well. The experimental intensity ratios between different line groups are between the experimental results of Matthew et al. (1980) and Larkins et al. (1977) for solid Au, and in obvious discrepancy with the calculated group intensity ratios based on McGuire's results (1974). (17 refs.)

32.80K Multiphoton processes

Stochastic ionization of excited atomic hydrogen in an electromagnetic-wave field .... See Entry 65940

Two-photon laser-induced fluorescence studies of HS radicals, DS radicals, and I atoms .... See Entry 66042

Two-photon transitions in positronium .... See Entry 66162

Influence of nonlinear frequency mixing on multiphoton ionization of gases .... See Entry 66667

32.90 OTHER TOPICS IN ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS

Superrradiance: an essay on the theory of collective spontaneous emission .... See Entry 66247

33.00 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS

65943 On the time variable in the description of molecular systems: from molecular transients to biomolecules. J.Durup (Univ. Paris-Sud, Orsay, France).
Comments At. & Mol. Phys. (GB), vol.12, no.5-6, p.255-76 (1983).
It is argued that the observation of very fast (subnanosecond) evolution processes in excited molecules should be more precise in energy-resolved rather than in time-resolved experiments. However, time representations are very useful for a comprehensive description especially of complex phenomena, and they always are present in mind in the case of systems where branching between competitive pathways occur. Therefore, explicit formulations of time evolution of the wavefunction of such systems are recalled. It is shown that in some cases a semiclassical representation in terms of the 'eigentime' of the excited molecule, using a function analogous to a Wigner function, yields the correct result. This kind of representation is further used for defining a characteristic time for dissociation processes, which is in turn compared with its classical counterpart. Finally, it is described how competition between relaxation and reaction in transient enzyme-substrate complexes may lead to unusual time patterns which were shown by Ninio to be of major importance in biochemical selectivity. (15 refs.)

33.10 CALCULATION OF MOLECULAR SPECTRA

65944 Rotational analysis and deperturbation of the $C^2\Sigma^+$-$X^2\Sigma^+$ band systems of BeH and BeD. R.Colin, C.Dreze, M.Steinhauer (Lab. de Chimie Phys. Moleculaire, Univ. Libre de Bruxelles, Brussels, Belgium).
Can. J. Phys. (Canada), vol.61, no.4, p.641-55 (April 1983).
A new $C^2\Sigma^+$-$X^2\Sigma^+$ transition of BeH and BeD is observed in a beryllium arc in hydrogen or deuterium gas mixed with argon. The rotational analysis of the most intense of these strongly red degraded bands, which involve $v'=0$-2 for BeH and $v'=0$ for BeD, allows one to derive molecular constants for the new $C^2\Sigma^+$ state. The latter has a large internuclear equilibrium distance ($r_e=2.301$ Å) and a shallow potential energy minimum ($D_e'=8452\pm100$ cm^{-1}). The principal molecular constants are given. The *C-X* bands analyzed involve the higher vibrational levels of the $X^2\Sigma^+$ state and allow, therefore, a substantial improvement of the ground state molecular constants to be made and a good Rydberg-Klein-Rees (RKR) potential energy curve to be calculated. The limiting curve of the predissociation confirms the previous value of the dissociation energy ($D_e''=17426\pm100$ cm^{-1}) and indicates that a small maximum, less than 200 cm^{-1}, could exist at $r\simeq3.3$ Å in the ground state potential energy curve. Franck-Condon factors for the $C^2\Sigma^+$-$X^2\Sigma^+$ bands of BeH and BeD are also calculated. (18 refs.)

65945 Anomalous rotational state distribution for the O_2 photofragment in the UV photodissoication of ozone. J.J.Valentini (Chem. Div., Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.395-8 (15 April 1983).
The coherent anti-Stokes Raman scattering (CARS) spectrum of $O_2(^1\Delta_g)$ formed in the photodissociation of ozone at 266 nm is presented. An anomalous propensity for even ($J=2,4,6,\ldots$) rotational states is observed. This propensity effect is discussed in terms of symmetry restrictions and dynamical bias in the photolysis. (10 refs.)

65946 Measurement of the fragment kinetic energy distribution in laser photopredissociation of N_2O^+. J.Lerme, S.Abed, R.A.Holt, M.Larzilliere, M.Carre (Lab. de Spectrometrie Ionique et Moleculaire, Univ. Lyon I, Villeurbanne, France).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.403-6 (15 April 1983).
Using an electrostatic energy analyzer together with a fast-ion-beam laser spectrometer, the authors have measured the kinetic energy spectrum of NO^+ ions produced in the slow predissociation of N_2O^+ prepared in specific vibrational and rotational levels of the Ã excited electronic state. For either the $\tilde{A}^2\Sigma^+(100)$ or $\tilde{A}^2\Pi(b)(110)$ states the resulting distribution is remarkably narrow, with almost all of the NO^+ ions produced in the $v''=4$ vibrational level. (24 refs.)

65947 Direct observation of molecular rotation-translation coupling by far-infrared spectroscopy. G.J.Evans, M.W.Evans (Edward Davies Chem. Labs., Univ. Coll. of Wales, Aberystwyth, Wales).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.416-18 (15 April 1983).
The differences between the far-infrared absorption of liquid (+) 3-methylcyclohexanone and the racemic mixture are interpreted as supporting evidence for the direct observation of rotation-translation coupling. (9 refs.)

65948 Uniform semiclassical self-consistent-field calculations of vibrational resonance energies and widths. D.Farrelly, R.M.Hedges,Jr., W.P.Reinhardt (Dept. of Chem., Univ. of Colorado, Boulder, CO, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.599-603 (22 April 1983).
Using the Breit-Wigner definition of a resonance, the authors calculate both resonance positions and widths for a model nonseparable hamiltonian, using a uniform semiclassical self-consistent-field (SCF) method. Excellent agreement with recent complex-coordinate quantum SCF calculations is obtained. (28 refs.)

65949 Substituted benzenes. IV. Normal coordinate analysis of mono iodonitrobenzenes. P.Muralidhar Rao, G.Ramana Rao (Dept. of Phys., Univ. Coll., Kakatiya, Warangal, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.949-53 (Dec. 1982). [received: April 1983]
Ortho-, meta- and para-iodonitrobenzenes are subjected to normal coordinate analysis using a 36-parameter modifed valence force field for the in-plane vibrations. The force constants are refined by the method of least-squares employing the vibrational frequencies of the three molecules. The potential energy distributions are computed in internal force constants and used to classify the normal vibrations on a quantitative basis. The nature of the absorption bands is examined in relation to the mixing of the vibrational modes and revised assignments are suggested in some cases. (19 refs.)

65950 Vibrational analysis of uranyl tetrachloride complexes. A.Natarajan, S.Somasundaram (Dept. of Phys., Autonomous PG Centre, Tiruchirapalli, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.784-6 (Oct. 1982). [received: April 1983]
A normal coordinate analysis of some metallic uranyl tetrachloride complexes $M_2UO_2Cl_4$(M=K, Rb, Cs and NH_4) has been made, neglecting the outer M^+ ions, on the basis of general valence force field. The molecular constants viz. the mean amplitudes of vibration, the generalised mean square amplitudes of vibration, the shrinkage constants, Coriolis coupling coefficients and the centrifugal distortion constants have also been computed for the first time using the structural parameters and the vibrational frequencies. (21 refs.)

65951 Halogen-substituted amides. IV. Normal coordinate treatment of N-methylcarbamoyl bromide. E.Krishna Murthy, K.Sree Ramulu, G.Ramana Rao (Dept. of Phys., Kakatiya Univ., Warangal, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.787-9 (Oct. 1982). [received: April 1983]
For pt.III see ibid., vol.20, no.5, p.372-8 (1983). The normal coordinate treatment of N-methylcarbamoyl bromide has been carried out using a modified valence force field. The force constants are refined by the method of damped least-squares. The potential energy distributions are evluated both in internal force constants and symmetry coordinates. The results are discussed in relation to the mixing of the vibrational modes. (8 refs.)

65952 Mean amplitudes of vibration and Coriolis coupling coefficients of some octrahedral ions. C.Loganathan (Dept. of Phys., Erode Arts Coll., Erode, India), V.Sengodan, K.G.Srinivasacharya.
Indian J. Pure & Appl. Phys., vol.20, no.10, p.832-3 (Oct. 1982). [received: April 1983]
Kinetic constants method is employed to evaluate a fresh set of force constants for some XY_6 octahedral type ions using the recent vibrational frequencies. The force constants obtained are used to calculate the mean amplitude of vibration and Coriolis coupling coefficients. The results are briefly discussed. (10 refs.)

65953 Centrifugal distortion constants of platinum (IV) complexes. R.Sambathu, K.G.Srinivasacharya (Dept. of Phys., PSG Coll. of Arts and Sci., Coimbatore, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.834 (Oct. 1982). [received: April 1983]
The centrifugal distortion constants of six PtX_4L_2(X=Cl or Br; L=P,S or As) complexes are evaluated using Cyvin's modified theory. (5 refs.)

65954 Molecular constants of H_2S and D_2S using harmonic frequencies. R.Sambathu, K.G.Srinivasacharya (Dept. of Phys., PSG Coll. of Arts & Sci., Coimbatore, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.835-6 (Oct. 1982). [received: April 1983]
Using the anharmonicity correction factors for the molecules H_2S and D_2S, the harmonic frequencies are obtained and are used to evaluate the molecular constants for these two molecules. The evaluated values of the inertia defects for H_2S and D_2S and the centrifugal distortion constants for the H_2S are compared with the experimental values and the agreement is found to be good. (15 refs.)

65955 Vibrational frequencies for silaacetylene and its silylidene and vinylidene isomers [and molecular structures]. M.R.Hoffmann, Y.Yoshioka, H.F.Schaefer,III (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1084-8 (9 March 1983).
The molecular structures, vibrational frequencies, and relative energies of silaacetylene and its vinylidene and silylidene isomers have been investigated via nonempirical molecular electronic theoretical methods. Basis sets of double ζ (DZ) and double-ζ plus d function quality have been used for this purpose in conjunction with self-consistent-field (SCF) and configuration interaction (CI) wave functions. The largest CI included in a completely variational manner 8001 configurations, and analytic CI gradient methods were used to determine the structure and harmonic vibrational frequencies of silaacetylene itself. The absolute minimum on the potential energy hypersurface is the silylidene, :Si=CH_2, which lies ~50 kcal below the linear silaacetylene. The vinylidene isomer H_2Si=C: is either an extremely shallow minimum, or, more likely, not a genuine relative minimum at all. Silaacetylene is predicted to have a trans bent equilibrium geometry. (30 refs.)

65956 Sum and density of states for anharmonic polyatomic molecules. Effect of bend-stretch coupling. L.B.Bhuiyan, W.L.Hase (Dept. of Chem., Wayne State Univ., Detroit, MI, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5052-8 (15 April 1983).
A model anharmonic molecular Hamiltonian is used to study the effect of nonseparable bend-stretch coupling on sum and density of states. A bond-energy-bond-order (BEBO) type method is used to couple bending and stretching potential energy terms of a local mode Hamiltonian. The model Hamiltonian is applied to the hydrocarbon fragments H-C≡C, H-C=C, and H-C-C. The results show significant deviation from the independent oscillator model, especially when the stretches are taken to be the Morse type and the energy is close to the dissociation limit. (29 refs.)

65957 The multistate vibronic coupling problem. L.S.Cederbaum (Inst. fur Phys. Chem., Univ. Heidelberg, Heidelberg, Germany).
J. Chem. Phys. (USA), vol.78, no.9, p.5714-28 (1 May 1983).
The interaction of several closely lying electronic states through a vibrational mode is discussed. Several examples are studied which show that this interaction may lead to strong nonadiabatic effects not present in a two-stage vibronic coupling problem. Special attention is paid to the vibronic coupling problem in a manifold of randomly distributed electronic states with random coupling. A large number of computations have been peromed for such randomly determined electronic systems. In spite of the randomness of the energies and coupling constants, the calculated spectra show some joint trends and regularities. (57 refs.)

65958 Rotational analysis of the (0-3) band in the 3*A* system of $^{14}C^{16}O$. T.Siwiec-Rytel (Atomic & Molecular Phys. Lab., Pedagogical Coll., Rzeszow, Poland).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.234-43 (Feb. 1983).
The (0-3) band of the 3*A* system in the $^{14}C^{16}O$ isotopic molecule was obtained at high dispersion and the resulting spectrum analyzed. Constants describing the $\nu=0$ level of the $c^3\Pi$ state and the $\nu=3$ level of the $a^3\Pi$ state are reported. For the *c* state, spin splitting was resolved for the first time and a perturbation of the low *J*-valued level structure induced by a previously unreported $^3\Pi$ state is reported. Deperturbation of the $c^3\Pi$ state's structure leads to partial characterization of the perturbing $^3\Pi$ state. (7 refs.)

65959 cis acrolein: mixing of the S_0 and S_1 electronic states by the (a'') skeletal torsional vibration. K.K.Innes (Dept. of Chem., State Univ. of New York, Binghamton, NY, USA).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.420-4 (Feb. 1983).
Large effects of vibronic coupling upon vibrational levels of the ground ($^1A'$) and first excited ($^1A''$) singlet electronic states of cis acrolein (2-propenal) are successfully modeled. Some implications for $CH_2=CH\text{-}CHO$ spectroscopy and photophysics are discussed briefly. (11 refs.)

65960 New model for the rotational level of the H_2O ground state. V.I.Starikov, V.G.Tyuterev.
Opt. & Spectrosc. (USA), vol.53, no.3, p.333-5 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.564-6 (Sept. 1982). [received: May 1983] (3 refs.)

65961 Pade form of effective rotational molecular Hamiltonians. V.N.Bryukhanov, Yu.S.Makushkin, Vl.G.Tyuterev, V.N.Cherepanov (Inst. of Atmospheric Optics, Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.756-9 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.86-90 (Aug. 1982). [received: April 1983]
Effective rotational molecular Hamiltonians (ERH) are constructed which differ from the traditional representation of the ERH as a power series in the total angular momentum. A Pade-form of the ERH is systematically obtained and the nonuniqueness of this form is emphasized. (14 refs.)

65962 Calculation of the dependence of the centrifugal constants of the molecule H_2O on the quantum number v_2 on the basis of the Morse oscillator. V.I.Starikov, Vl.G.Tyuterev (Inst. of Atmospheric Optics, Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.762-5 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.93-6 (Aug. 1982). [received: April 1983]
An explanation is given for the anomalous dependence of the centrifugal distortion in flexible molecules of the type H_2O on the 'bending' quantum number v_2 on the basis of the Morse oscillator. A computation of the dependence of the rapidly varying rotational, quartic, sextic constants of the molecule H_2O on v_2 describes the experimental behavior of these constants well. (11 refs.)

On the basis set superposition error in potential surface investigations. I. Hydrogen-bonded complexes with standard basis set functions .... See Entry 65866

Rydberg states with a $^2\Pi$ core: the $b^3\Pi_i$ and $C^2\Pi$ states of DCl .... See Entry 65901

Collisional effects on the rovibrational transitions of the HD fundamental band .... See Entry 65963

Microwave structure measurements on the cyclopropane-HCN complex .... See Entry 65965

Microwave, infrared and Raman spectra and structure of 2-nitropropane .... See Entry 65966

Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate .... See Entry 65967

Millimeter-wave spectrum of ethyl acetylene centrifugal distortion, Coriolis interaction and internal rotation .... See Entry 65968

The translational-rotational absorption spectrum of hydrogen . See Entry 65969

The electronic absorption spectrum of the CNO free radical in the gas phase .... See Entry 65972

Infrared and Raman study of the interaction between methyl acetate and phenol derivatives .... See Entry 65973

Velocity-modulated infrared laser spectroscopy of molecular ions: the ν_1 band of HNN^+ .... See Entry 65976

Vibrational spectra and force constants of symmetric tops: rovibrational spectra in the ν_3 region of monoisotopic species of H_3GeCl, H_3GeBr, and H_3GeI .... See Entry 65979

Vibrational analysis of a series of n-alkyl fluorides in the solid state .... See Entry 65985

Vibrational spectra, isolated CH stretching frequencies and CH bond lengths in CH_3OCH_2X compounds (X=F, Cl, Cr, I) .... See Entry 65987

Molecular structure, vibrational spectra and normal coordinate analysis of S-methyl dithiocarbamate .... See Entry 65988

Infrared intensities of pregn-1,4-diene-3,20-dione derivatives ...See Entry 65989

Integral emission and absorption characteristics of CO_2 and CO bands in conditions of vibrational disequilibrium .... See Entry 65991

Vibrational spectra and rotational isomerism of 1,2-dimethyldisilane .... See Entry 65992

Resonance Raman scattering with a forbidden but vibronically allowed electronic transition: excitation profiles of combinations and overtones of copper tetraphenylporphyrin in the Q-band resonance .... See Entry 65993

Theoretical study of the effects of vibrational-rotational interactions on the Raman spectrum of N_2 .... See Entry 65995

Vibrational spectra and normal coordinate analysis of *p*-bis(dimethylhydroxy-silil)benzene-d_0 and $-d_4$ .... See Entry 65997

Raman and IR studies of the antileprotic drug Dapsone .... See Entry 65999

Electronic absorption and emission studies of the Group IIIA metal suboxides isolated in cryogenic rare gas matrices .... See Entry 66000

Observation by laser ionization spectroscopy of vibrationally excited nitric oxide following $O(^1D_2)+N_2O \rightarrow 2NO$ .... See Entry 66004

Analysis of the 254.7 nm absorption system of carbonyl fluoride .... See Entry 66006

On the estimation of relaxation contributions to internal motion .... See Entry 66013

Vibrationally averaged structure of azulene partially oriented in a nematic phase .... See Entry 66016

Highly resolved electronic spectra and electronic structure of benzo[f]quinoxaline .... See Entry 66059

Highly resolved electronic absorption and luminescence spectra of some phenanthrolines in Shpolskii matrices. II. Fluorescence and $S_1 \leftarrow S_0$ absorption spectra .... See Entry 66060

The electron angular distribution of different rotational branches in the VUV photoelectron spectrum of H_2 .... See Entry 66066

Algorithm for evaluating Franck-Condon integrals .... See Entry 66075

Dynamics of photodissociation of HONO at 369 nm: motional anisotropy and internal state distribution of the OH fragment .... See Entry 66080

The $\tilde{A}^1A_1$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,2-difluorobenzene .... See Entry 66085

Molecular constants and thermodynamic properties of some planar XY_3-type molecules .... See Entry 66157

3-methyl-3-butenenitrile and 3-bromo-2-methyl-1-propene: normal coordinate calculations based on valence force fields .... See Entry 66158

The pure rotation spectrum of the hydroxyl radical and the solar oxygen abundance .... See Entry 69493

33.20 MOLECULAR SPECTRA GROUPED BY WAVELENGTH RANGES

(for magneto-optical and electro-optical spectra, see 33.45; for fluorescence and phosphorescence spectra, see 33.50; for photoelectron spectra, see 33.65)

65963 Collisional effects on the rovibrational transitions of the HD fundamental band. S.Nazemi, A.Javan (Dept. of Phys., MIT, Cambridge, MA, USA), A.S.Pine.
J. Chem. Phys. (USA), vol.78, no.8, p.4797-805 (15 April 1983).
The effect of collisions with self and buffer gases, Ar, Kr, and Xe, on the linewidth, line shape, and frequency of the rovibrational transitions of HD in its ground electronic state are studied with a high-resolution tunable laser difference-frequency spectrometer. Collisional narrowing, manifested in sub-Doppler width of the transitions, is observed (for the first time in HD) in both *P* and *R* branches of the infrared fundamental band. The measured line profiles and the pressure dependence of their widths are analyzed in the limits of strong and weak velocity-changing collisions. It is shown that both models fit the data equally well in the low pressure range (below about 300 Torr). The strong collision model, however, is found to be the best fit for HD/HD collisions in the entire 10-760 Torr pressure range. In the case of HD/buffer gas collisions, a model incorporating correlations between the velocity and state-changing collisions appears to be more appropriate. The dependence of collisional narrowing and broadening parameters on the rotational quantum number is reported and discussed. (35 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ... See Entry 64573

Time resolved high resolution spectroscopy using the high frequency deflection technique and supersonic jet targets. I. Instrumental; simplification of spectra; reductions of collisional quenching .... See Entry 64961

Theory of impact broadening of the rotational ammonia spectrum .... See Entry 66074

3-methyl-3-butenenitrile and 3-bromo-2-methyl-1-propene: normal coordinate calculations based on valence force fields .... See Entry 66158

33.20B Radiofrequency and microwave spectra

(for NMR spectra, see 33.25; for EPR spectra, see 33.30)

65964 The nuclear hyperfine structure of deuterated ammonia. M.Bester, S.Urban, K.Yamada, G.Winnewisser (I. Phys. Inst., Univ. zu Koln, Koln, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.L13-14 (May 1983).
The ^{14}N nuclear hyperfine splitting of $^{14}NH_2D$ is reported for the two inversion components of the 1_{11}-1_{01} rotational transition centered at 85926.263(10) MHz and 110153.599(10) MHz. These precise laboratory measurements should aid further interstellar searches of NH_2D. (10 refs.)

65965 Microwave structure measurements on the cyclopropane-HCN complex. S.G.Kukolich (Dept. of Chem., Univ. of Arizona, Tucson, AZ, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4832-5 (15 April 1983).
Microwave rotational transitions for the cyclopropane-HCN complex were observed using the Flygare-Balle pulsed beam Fourier transform spectrometer. The $1_{11}\rightarrow 2_{12}$, $1_{01}\rightarrow 2_{02}$, $1_{10}\rightarrow 2_{11}$, $2_{12}\rightarrow 3_{13}$, $2_{02}\rightarrow 3_{03}$, $2_{11}\rightarrow 3_{12}$, $3_{13}\rightarrow 4_{14}$, $3_{03}\rightarrow 4_{04}$, $3_{12}\rightarrow 4_{13}$, $4_{14}\rightarrow 5_{15}$, $4_{04}\rightarrow 5_{05}$, and $4_{13}\rightarrow 5_{14}$ transitions were observed. The rotational constants obtained are $A=20243\pm 1344$ MHz, $B=1384.209\pm 0.001$ MHz, and $C=1327.901\pm 0.001$ MHz. The distortion constants are $D_J=1.53\pm 0.03$ kHz and $D_{JK}=50.9\pm 1.1$ kHz. The nitrogen quadrupole coupling strength is $eQq_{aa}=-4.38\pm 0.01$ MHz with eQq_{bb}-$eQq_{cc}=0.002\pm 0.003$ MHz. The cyclopropane carbon atoms and HCN lie in a plane. The most reasonable bond distance is obtained with the HCN hydrogen atom bonding to the midpoint between two of the cyclopropane carbon atoms. The separation of the centers of mass of HCN and cyclopropane is $R_{cm}=4.472\pm 0.002$ Å. The HCN carbon atom is $R_{CC\text{-}C}=3.476\pm 0.002$ Å from the cyclopropane carbon-carbon bond. The stretching force constant is $k_s=0.062$ mdyn/Å and the approximate bonding energy is 860 cm^{-1}. (18 refs.)

65966 Microwave, infrared and Raman spectra and structure of 2-nitropropane. J.R.Durig, J.A.S.Smith, Y.S.Li, F.M.Wasacz (Dept. of Chem., Univ. of South Carolina, Columbia, SC, USA).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.45-60 (May 1983).
The microwave spectrum of 2-nitropropane, $C_3H_7NO_2$, has been investigated from 12.5 to 40.0 GHz. Only α-type transitions were observed and *R*-branch assignments are made for the ground vibrational state. The effective rotational constants are found to have the following values: $A=5132\pm 12$, $B=2895.70\pm 0.14$, and $C=2706.51\pm 0.12$ MHz. It is shown that these rotational constants are only consistent for the conformer where one N=O bond eclipses the C-H bond. From a diagnostic least-squares adjustment to fit these three rotational constants along with reasonably assumed structural parameters for the isopropyl moiety, excluding the C-C distance, the following parameters are obtained: r(C-C)$=1.533\pm 0.006$ Å, r(C-N)$=1.508\pm 0.018$ Å, r(N=O)$=1.218\pm 0.015$ Å, spherical angle CNO$=116.8\pm 1.5°$, and spherical angle CCN$=108.9\pm 1.7°$. From a temperature study of the microwave spectrum, it appears that the NO_2 group is nearly freely rotating. The IR (3500-80 cm^{-1}) and Raman (3500-10 cm^{-1}) spectra have been recorded for both the gaseous and solid phases of 2-nitropropane. The Raman spectrum of the liquid has also been recorded and qualitative depolarization values obtained. (27 refs.)

65967 Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate. J.R.Durig, K.J.Kanes, J.F.Sullivan (Dept. of Chem., Univ. of South Carolina, Columbia, SC, USA).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.61-76 (May 1983).
The low resolution microwave spectrum of isopropylisocyanate, $(CH_3)_2CHNCO$, has been recorded from 18.0 to 39.0 GHz. From the spacing of the major transitions it is shown that the value of 4031 MHz for $B+C$ is consistent with the skew conformer with a C-N=C angle of ca. 139° where the NCO moiety is eclipsing one of the methyl groups, although the trans conformer where the lone pair of electrons on the nitrogen is eclipsing the hydrogen atom cannot be entirely ruled out. The infrared (3200-50 cm^{-1}) and the Raman (3300-20 cm^{-1}) spectra have been recorded for gaseous and solid isopropyliso-cyanate. Additionally, the Raman spectrum of the liquid has been obtained and qualitative depolarization values measured. There is little indication of the presence of a second conformer at ambient temperature from a comparison of the vibrational data for the fluid and solid phases. A complete vibrational analysis, based on infrared band contours, depolarization values and group frequencies, is proposed. (22 refs.)

65968 Millimeter-wave spectrum of ethyl acetylene centrifugal distortion, Coriolis interaction and internal rotation. J.Demaison, D.Boucher, J.Burie, A.Dubrulle (Lab. de Spectroscopie Hertzienne, Univ. de Lille I, Villeneuve-d'Ascq, France).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.447-51 (April 1983).
The rotational spectrum of ethylacetylene has been investigated between 70 and 320 GHz. A Coriolis interaction has been found between the first excited state of the methyl torsion and the C-C≡C in plane deformation. Splittings of transitions in the first excited torsional state show that the barrier hindering internal rotation of the methyl group amounts to 3271 cal/mole. (12 refs.)

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{14}NH_3$ ....See Entry 66083

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{15}NH_3$ ....See Entry 66084

Laboratory measurement of the 4_{04}-3_{13} 70 GHz transition ground-state methylene (CH_2) ....See Entry 69489

33.20E Infrared spectra

65969 The translational-rotational absorption spectrum of hydrogen. G.Bachet (Lab. des Interactions Atomiques et Moleculaires, CNRS, Marseilles, France), E.R.Cohen, P.Dore, G.Birnbaum.
Can. J. Phys. (Canada), vol.61, no.4, p.591-603 (April 1983).
The collision-induced translational-rotational spectrum of H_2 has been accurately measured in the region from about 30 to 2000 cm^{-1} at 195 and 297K. A very weak feature due to the hexadecapole-induced dipole, the $U_0(1)$ line, has been detected at 195K in the region around 1622 cm^{-1}. These spectra can be accurately represented by a simple, semi-empirical line shape. The effect of double transitions are considered and explicit expressions for these are given. Spectral integrals proportional to the zero and first moments are determined experimentally and compared with the theoretical moments computed on the basis of quadrupole induction for several potentials. The difference between the experimental and theoretical values, in the order of 20%, is attributed to anisotropic overlap induction, but the inferred magnitude of this component is strongly dependent on the assumed potential. (40 refs.)

65970 Collision-induced absorption in ethane-rare gas mixtures. I.R.Dagg, L.A.A.Read, A.Anderson (Univ. of Waterloo, Waterloo, Ontario, Canada).
Can. J. Phys. (Canada), vol.61, no.4, p.633-40 (April 1983).
The collision-induced spectra of mixtures of ethane and each of the rare gases He, Ar, Kr, and Xe in the 40-360 cm^{-1} region have been obtained using a Michelson Fourier transform spectrometer. In addition, the temperature dependence of the absorption in ethane and ethane-xenon mixtures is reported. All results have been analyzed according to the theory for quadrupole induced rotation-translation absorption. The absolute value of the quadrupole moment of ethane is estimated to be less than 1.0 B and most likely less than 0.5 B. Various speculations are made concerning the induction mechanisms (other than quadrupolar) for each of the mixtures. (14 refs.)

65971 Infrared linear dichroism of the T_1 state of acridine in stretched polyethylene. M.B.Mitchell, W.A.Guillory, J.Michl, J.Radziszewski (Dept. of Chem., Univ. of Utah, Salt Lake City, UT, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.413-15 (15 April 1983).
Reports the first determination of the symmetry of an excited-state vibration observed with direct infrared absorption. The authors assign the excited triplet-state vibration of acridine at 751 cm^{-1} to b_1 symmetry. (3 refs.)

65972 The electronic absorption spectrum of the CNO free radical in the gas phase. D.A.Ramsay, M.Winnewisser (Herzberg Inst. of Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.502-4 (15 April 1983).
A new band with heads at 7963.3 and 7893.1 Å has been found during the flash photolysis of 3-methyl-4-oximinoisoxazol-5(4H)-one. By comparison with earlier work in a neon matrix, and on the basis of a partial rotational analysis, the band is assigned as the 0-0 band of the $A^2\Sigma^+$-$X^2\Pi_i$ transition of the CNO free radical. Preliminary molecular constants are given. (9 refs.)

65973 Infrared and Raman study of the interaction between methyl acetate and phenol derivatives. L.Vanderheyden, Th.Zeegers-Huyskens (Dept. of Chem., Univ. of Leuven, Heverlee, Belgium).
J. Mol. Liq. (Netherlands), vol.25, no.1, p.1-11 (March 1983).
In previous publications the authors have been concerned with the influence of hydrogen bond formation on the Raman intensity of the carbonyl stretching vibration. Hydrogen bond association of simple carbonyl bases (cyclohexanone, acetone, acetophenone) with proton donors such as phenol derivatives, hydrochloridic or hydrobromic acid brings about an intensity increase of the $\nu_{C=O}$ Raman band; moreover, the intensity enhancement is linearly related to the enthalphy of complex formation. These measurements are extended to the complexes formed between methyl acetate (MeAc) and phenol derivatives. (19 refs.)

65974 Infrared & Raman Spectra of vanillin. S.Tariq, P.K.Verma, R.Aquell (Dept. of Phys., Aligarh Muslim Univ., Aligarh, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.974-7 (Dec. 1982). [received: April 1983]
The infrared and Raman spectra of vanillin have been recorded in the region 4000-50 cm^{-1}. Hydrogen bond fundamentals and the torsion vibrations of the substituents are identified and discussed. The observed splitting of the carbonyl band is explained. Assignments of other fundamental vibrations are proposed assuming C_s symmetry for the molecule. (26 refs.)

65975 Bond polar parameters from infrared intensities in X_2CY molecules. B.Nikolova (Inst. of Organic Chem., Bulgarian Acad. of Sci., Sofia, Bulgaria), B.Galabov, C.Lozanova.
J. Chem. Phys. (USA), vol.78, no.8, p.4828-31 (15 April 1983).
The integrated gas-phase infrared intensities in F_2CO, Cl_2CO, F_2CS, and Cl_2CS are interpreted in terms of bond polar parameters using recently proposed parametric model of IR intensities. The calculated values for the bond parameters correlate with the electronegativities of the atoms forming the chemical bonds in these molecules. It is concluded that the band intensities in the infrared spectra of these systems are largely dependent on the static charge distribution. (19 refs.)

65976 Velocity-modulated infrared laser spectroscopy of molecular ions: the ν_1 band of HNN^+. C.S.Gudeman, M.H.Begemann, J.Pfaff, R.J.Saykally (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5837-8 (1 May 1983).
The authors report the first detection and measurement of the 3.1 μm ν_1 (NH stretch) vibration-rotation band of protonated nitrogen produced in an AC glow discharge using velocity-modulation and simple lock-in detection. (10 refs.)

65977 Infrared spectrum of CO adsorbed on a platinum electrode. J.W.Russell (Dept. of Chem., Oakland Univ., Rochester, MI, USA), M.Severson, K.Scanion, J.Overend, A.Bewick.
J. Phys. Chem. (USA), vol.87, no.2, p.293-7 (20 Jan. 1983).
Polarization-modulated infrared reflection-absorption spectroscopy has been used to measure directly the infared spectrum of CO adsorbed on the surface of a platinum electrode in the presence of an electrolyte, either 1 M H_2SO_4 or 1 M $HClO_4$. The band due to the CO-stretching vibration has been found to shift with applied potential, moving to higher wavenumber as the electrode potential is made more positive. The band shape and the band area remain essentially unchanged when the potential is changed over the range 15-650 mV (NHE). The results are interpreted as evidence that, in the case of CO on Pt, there is a significant contribution to coverage-dependent shifts from electrochemical interactions between substrate and adsorbate. (13 refs.)

65978 High-resolution Fourier spectrometry of $^{14}N_2$ infrared emission spectrum: extensive analysis of the $B^3\Pi_g$-$A^3\Sigma_u^+$ system. F.Roux, F.Michaud (Lab. de Spectrometrie Ionique et Moleculaire, Univ. Lyon I, Villeurbanne, France), J.Verges.
J. Mol. Spectrosc. (USA), vol.97, no.2, p.253-65 (Feb. 1983).
The $B^3\Pi_g$-$A^3\Sigma_u^+$ system of N_2 excited in a microwave discharge was recorded between 3000 and 18000 cm^{-1} with a high-resolution Fourier spectrometer. There are no observed irregularities in the levels of the $A^3\Sigma_u^+$ and $B^3\Pi_g$ states at least for the values of ν and J considered here, except the predissociation in the $B^3\Pi_g$ state for $\nu=12$ and J higher than 33. This predissociation will be checked with more complete data in another article. Thirty three bands of the first positive system with $0\leq\nu'\leq12$ and $0\leq\nu''\leq8$ are analyzed. The molecular parameters of the $B^3\Pi_g$ and $A^3\Sigma_u^+$ are obtained by a complete fitting procedure. Derived values of equilibrium constants and deduced; RKR potential energy curves for the two states are constructed, and the Franck-Condon factors calculated for the A-B system. (16 refs.)

65979 Vibrational spectra and force constants of symmetric tops: rovibrational spectra in the ν_3 region of monoisotopic species of H_3GeCl, H_3GeBr, and H_3GeI. H.Burger, K.Burczyk, R.Eujen, A.Rahner (Anorganische Chem., Univ. Wuppertal, Wuppertal, Germany), S.Cradock.
J. Mol. Spectrosc. (USA), vol.97, no.2, p.266-86 (Feb. 1983).
The gas phase infrared spectra of several monoisotopic species of H_3GeCl, H_3GeBr, and H_3GeI have been recorded in the ν_3 region near 420, 300, and 250 cm^{-1}, respectively, with a resolution between 0.03 and 0.04 cm^{-1}. Rotational J structure of the fundamental and of several 'hot' bands of ν_3 has been resolved and analyzed by means of polynomial methods. The K structure of J clusters is indicated, and $\alpha_3{}^A$ values were estimated from a band contour simulation. The molecular parameters $\nu_3{}^0$, x_{33}, $(B_3$-$B_0)$ and $\bar{D}_J$ were determined for several isotopic combinations. The ν_3 and $2\nu_3$ levels are apparently unperturbed except for $H_3Ge^{35}Cl$ species for which Fermi resonance between $2\nu_3$ and ν_2 has been established. (12 refs.)

65980 FTIR spectroscopic studies of the matrix photoionization and photolysis products of methylene halides. B.J.Kelsall, L.Andrews (Dept. of Chem., Univ. of Virginia, Charlottesville, VA, USA).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.362-78 (Feb. 1983).
Matrix photoionization of methylene bromide produced absorptions at 1019, 897, and 788 cm^{-1} identified previously as CBr_2^+, $CHBr_2^+$, and $CHBr_2$. High-resolution FTIR spectra revealed overlapping 1/2/1 triplets for natural bromine isotopes with individual linewidths near 0.2 cm^{-1}. New absorptions at 3121, 2897, and 1345 cm^{-1} are assigned to the $(CH_2Br^+)Br$ cation complex which yields $CHBr_2^+$ on photolysis. A substantially increased yield of the $CHCl_2^+$ species made possible observation of the C-H stretching mode at 3033 cm^{-1} and the symmetric C-Cl_2 stretching mode at 845 cm^{-1} along with the previously observed stronger 1291- and 1044-cm^{-1} fundamentals. The high resolution and enhanced signal-to-noise capability of the FTIR are clearly demonstrated in this investigation. (13 refs.)

65981 Infrared diode laser spectroscopy of the FO radical ($^2\Pi_{3/2}$). A.R.W.McKellar, C.Yamada, E.Hirota (Inst. for Molecular Sci., Okazaki, Japan).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.425-9 (Feb. 1983).
The fundamental band of the FO radical in the 9.6-μm region was studied using a tunable diode laser and a Zeeman-modulated multiple-traversal absorption cell. Although it was not possible to detect any transitions belonging to the $^2\Pi_{1/2}$ substate, 14 transitions of $^2\Pi_{3/2}$ were observed and accurately measured. Analysis of these measurements gave the following molecular parameters (with $A_0=A_1$ fixed at -177.3 cm^{-1}): $\nu_0=1033.4829(5)$ cm^{-1}, $B_0=1.05285(9)$ cm^{-1}, $B_1=1.03933(8)$ cm^{-1}, $D_0=4.4(4)\times10^{-6}$ cm^{-1}, and $D_1=4.4(3)\times10^{-6}$ cm^{-1}. (11 refs.)

65982 Infrared band intensities and bond polarities. Static and rehybridization dipole moment contibutions to infrared intensities in C_6F_6. B.Galabov, C.Lozanova (Dept. of Chem., Univ. of Sofia, Sofia, Bulgaria), W.J.Orville-Thomas.
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.17-22 (May 1983).
A recently developed parametric model of infrared intensities is used to determine static and rehybridization (or charge reorganization) bond dipole contributions to the infrared intensities in hexafluorobenzene. The individual bond moment constants obtained indicate that the integrated band intensities in the IR spectrum of this molecule are determined by both equilibrium charge distribution and charge fluxes accompanying the vibrational motion, the relative importance of the two effects depending on the type and symmetry of the vibrations. The intensity of the C-F bands associated with stretching vibrations is largely related to rehybridization dipole contributions while for the bending modes the equilibrium dipole terms make greater contributsions to the band intensities. (18 refs.)

65983 The characterization of alkali arsenites and antimonites: the IR spectra of matrix-isolated $MAsO_2$ and $MSbO_2$ molecules. L.Bencivenni (Dept. of Phys. Chem., Univ. of Rome, Rome, Italy), K.A.Gingerich.
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.23-9 (May 1983).
IR matrix-isolation experiments indicate the existence of gaseous alkali arsenites and antimonites. These molecules have been studied and characterized in detail by ^{18}O enrichment measurements. For these species, a C_{2v} ring structure with O-As-O and O-Sb-O angles of 115°±5 and 106°±5, respectively, has been proposed. (5 refs.)

65984 Infrared and Raman study and ab initio calculations of internal rotation in methylisopropenyl ether. E.Gallinella, U.Pincelli, B.Cadioli (Istituto di Chimica Fisica, Univ. di Modena, Modena, Italy).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.31-43 (May 1983).
The structure of methylisopropenyl ether and its rotational isomerism have been studied both by ab initio calculations and by IR and Raman spectra. The internal potential energy function shows the existence of two isomers; the more stable one has a planar s-cis structure, the second is predicted at 4.73 kcal mol^{-1} higher in a planar s-trans form with an interconversion barrier of about 7.5 kcal mol^{-1} at a torsional angle of 97°. The computer barrier heights to internal rotation of the two methyl groups are quite different: 0.9 kcal mol^{-1} for the methyl on carbon and 4.5 kcal mol^{-1} for the methyl on oxygen. Correlation of the orbital energies is made both with respect to methylvinyl ether and methane and to propene and methanol. The first two ionization potentials have also been measured at 8.97 and 11.7 eV. The vibrational spectra show that only the s-cis isomer can be found. An assignment of the complete spectra is proposed; the torsional frequency of the methyl on carbon could not be detected. (9 refs.)

65985 Vibrational analysis of a series of n-alkyl fluorides in the solid state. G.A.Crowder, J.M.Lightfoot (Dept. of Chem., West Texas State Univ., Canyon, TX, USA).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.77-91 (May 1983).
Liquid and solid-state IR spectra have been obtained for n-$C_7H_{15}F$, n-$C_8H_{17}F$, n-$C_9H_{19}F$, n-$C_{10}H_{21}F$, and n-$C_{14}H_{29}F$ and normal coordinate calculations made for the P_c and P_H conformers of each compound. Comparisons of observed solid-state frequencies with the calculated values show the P_H conformer to be the one present in the solid state of each compound. Vibrational assignments are made with the aid of the calculations. (10 refs.)

65986 Conformational analysis of 2-chloro-4-methylpentane and 2-bromo-4-methylpentane. G.A.Crowder, R.M.P.Jaiswal (Dept. of Chem., West Texas State Univ., Canyon, TX, USA).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.93-100 (May 1983).
Liquid and solid-state IR spectra for 2-chloro-4-methylpentane, briefly discussed in a preliminary communication, are presented, along with the results of previous normal coordinate calculations. Infrared spectra are also presented for 2-bromo-4-methylpentane. The spectra show the presence of two conformations in the neat liquid (S_{HH} and S_{CH}), but only the S_{HH} conformer is stable in the crystalline solid. Normal coordinate calculations have also been made for both conformers of the bromo compound, and the resulting assignments are given. Force constants for both compounds are also given. (6 refs.)

65987 Vibrational spectra, isolated CH stretching frequencies and CH bond lengths in CH_3OCH_2X compounds (X=F, Cl, Cr, I). D.C.McKean, I.Torto, A.R.Morrisson (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.101-18 (May 1983).
Infrared and Raman spectra are reported for CH_3OCH_2X, CHD_2OCD_2X, $CD_32OCHDX$ (X=F, Cl, Br, I) and for CH_3OCD_2Cl and CD_3OCH_2Cl, in various phases. $\nu_C V_H{}^{is}$ values are obtained which enable CH bond lengths and dissociation energies to be predicted. The changes in bond lengths for Me_2O to $MeOCH_2X$ and from $MeOCH_2F$ to $MeOCH_2Cl$ are in good agreement with those calculated ab initio and in radical disagreement with microwave-based values. The effect of halogen is to strengthen all the CH bonds present, especially that lying parallel to the CX one. All major features in the spectra are explained if only the gauche skeletal conformer exists in the phases studied. However, two transient bonds in solid films of CH_3OCH_2F may indicate the presence of a metastable trans conformer phase. (16 refs.)

65988 Molecular structure, vibrational spectra and normal coordinate analysis of S-methyl dithiocarbamate. R.Mattes, L.Zhengyan, M.Thunemann, H.Schnockel (Inst. of Inorganic Chem., Univ. of Muenster, Muenster, Germany).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.119-32 (May 1983).
The crystal structure of *S*-methyl dithiocarbamate (SMDTC) has been determined by single crystal X-ray diffraction. The IR spectra, matrix IR spectra and Raman spectra os SMDTC-d_0, $-d_2$ and $-d_3$ have been measured between 4000 and 30 cm^{-1}. Raman spectra in solution and in the molten state have also been obtained. The assignments are supported from a normal coordinate analysis. In the solid state SMDTC exists as the E conformer. In solution and in the liquid state two conformers are found; in the matrix spectra only one, probably the E conformer, is observed. (29 refs.)

65989 Infrared intensities of pregn-1,4-diene-3,20-dione derivatives. O.Egyed, G.Jalsovszky, S.Holly (Central Res. Inst. for Chem., Hungarian Acad. of Sci., Budapest, Hungary).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.133-6 (May 1983).
The IR absorption intensities of the νC=O and νC=C bands of some pregn-1, 4-diene-3, 20-dione derivatives have been determined by means of a Fourier-transform infrared spectrometer. The integrated intensities were calculated by fitting Gauss-Cauchy sum functions to the experimental spectra using an iterative non-linear least-squares method and numerical integration. The intensities of the A-ring vibrations of pregn-4-ene-3,20-dione and pregn-1,4-diene-3,20-dione derivatives were compared, and the νC=O band intensities of different 21-acylated derivatives were investigated. (7 refs.)

65990 Conformation behaviour of dimethylmethylphosphonate and methyldimethylphosphinate studied by infrared spectroscopy in low-temperature matrices. A.J.Barnes, S.Lomax (Dept. of Chem. & Appl. Chem., Univ. of Salford, Salford, England), B.J.Van Der Veken.
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.137-45 (May 1983).
Infrared spectra are reported for dimethylmethylphosphonate (DMMP) and methyldimethylphosphinate (MDMP) in argon, methane, nitrogen and carbon monoxide matrices at 20K and compared with spectra in gas, solution, liquid and solid phases. Evidence is presented for the existence of three conformers of DMMP, one of which has a low dipole moment and is the only conformer found in the gas phase, while the other two, polar, conformers occur in the liquid phase. In matrices or solutions the conformational distribution depends on the polarity of the medium. For MDMP, no conclusive evidence has been found for the existence of more than one conformer in matrices. (7 refs.)

65991 Integral emission and absorption characteristics of CO_2 and CO bands in conditions of vibrational disequilibrium. N.N.Kudryavtsev, S.S.Novikov.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.831-6 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.125-32 (July 1982). [received: March 1983]
A numerical investigation was performed of the influence of the parameters of a vibrationally nonequilibrium gas on the integral emission and absorption characteristics of CO_2 molecules in the 4.3- and 2.7-μm bands and of CO molecules in the 4.7-μm band. The reason for investigating the integral characteristics of the vibrational-rotational bands was that the low emission intensity of the gas in the given conditions, in combination with the requirements of ensuring sufficient sensitivity of the optical systems with high time resolution, leads to the need to record radiation in broad spectral ranges, corresponding to the whole, or a considerable part, of the band. (14 refs.)

65992 Vibrational spectra and rotational isomerism of 1,2-dimethyldisilane. K.Ohno, M.Hayashi, H.Murata (Dept. of Chem., Hiroshima Univ., Hiroshima, Japan).
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.373-82 (1983).
The IR and Raman spectra of 1,2-dimethyldisilane and its Si-perdeuterated species have been measured for the liquid and solid states. Existence of rotational isomers about the Si-Si bond was shown on the basis of the spectral examination and the normal coordinate treatment. The fundamental vibrations were assigned for the two possible rotational isomers. (21 refs.)

Direct observation of molecular rotation-translation coupling by far-infrared spectroscopy .... See Entry 65947

Microwave, infrared and Raman spectra and structure of 2-nitropropane .... See Entry 65966

Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate .... See Entry 65967

The spectra and structure of diboron trioxide .... See Entry 65994

Vibrational spectra and normal coordinate analysis of *p*-bis(dimethylhydroxy-silil)benzene-d_0 and $-d_4$ .... See Entry 65997

Raman and IR studies of the antileprotic drug Dapsone .... See Entry 65999

Further measurement and analysis of lines in the LMR spectrum of HCO at 5.3 μm .... See Entry 66032

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{14}NH_3$ .... See Entry 66083

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{15}NH_3$ .... See Entry 66084

Molecular constants and thermodynamic properties of some planar XY_3-type molecules .... See Entry 66157

Development of colour centre lasers for spectroscopy applications .... See Entry 66285

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 .... See Entry 66953

Structure of anions and neutral molecules of selenazolidine-2,4-dione .... See Entry 66978

Novel features in the stereochemistry of octacyanides: phase transition in tetra-n-butylammonium octacyanotungstate(V) .... See Entry 68191

Intramolecular vibrations in ICE. Interpretation of experiments on the isotopic isolation of H_2O molecules .... See Entry 68204

The role of C=O transition dipole-dipole coupling interaction in uracil .... See Entry 68232

Normal coordinate analysis treatment on uracil in solid state .... See Entry 68233

The temperature-dependence of the far-infrared spectra of L-alanine .... See Entry 68234

The adsorption of CO on Pt(111) studied by infrared reflection-adsorption spectroscopy .... See Entry 68237

Perturbation of the hydrogen-bond equilibrium in nucleic bases. An infrared study .... See Entry 68920

The pure rotation spectrum of the hydroxyl radical and the solar oxygen abundance .... See Entry 69493

33.20F Raman and Rayleigh spectra

(inc. scattering)

65993 Resonance Raman scattering with a forbidden but vibronically allowed electronic transition: excitation profiles of combinations and overtones of copper tetraphenylporphyrin in the Q-band resonance. S.Aramaki, H.Hamaguchi, M.Tasumi (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.555-9 (22 April 1983).
Resonance Raman scattering with the Q band of CuTPP shows a peculiar intensity pattern; bands due to combinations and overtones are strong, whereas the corresponding fundamentals are very weak. By a quantitative analysis of excitation profiles, this phenomenon has been fully accounted for on the basis of the vibronic theory of Raman intensities. Vibronic coupling parameters between the Q and B states of CuTPP have been obtained. (16 refs.)

65994 The spectra and structure of diboron trioxide. L.V.Serebrennikov, Yu.N.Sekachev, A.A.Maltsev (Dept. of Chem., Moscow State Univ., Moscow, USSR).
High Temp. Sci. (USA), vol.16, no.1, p.23-34 (Feb. 1983).
The infrared spectra of $^{10,11}B_2{}^{16,18}O_3$ molecules isolated in argon and xenon matrices have been studied in the 3200-4000 cm^{-1} region. The Raman spectrum of natural B_2O_3 has been obtained. The following set of fundamentals is suggested for diboron trioxide: A_1:2061, 1062, 462 (or 489), and 73 cm^{-1}; B_1:2061 (1062) and 489 cm^{-1}. Plausible structures for the B_2O_3 molecule have been discussed. (32 refs.)

65995 Theoretical study of the effects of vibrational-rotational interactions on the Raman spectrum of N_2. S.R.Langhoff, C.W.Bauschlicher,Jr. (NASA Ames Res. Center, Moffett Field, CA, USA), D.P.Chong.
J. Chem. Phys. (USA), vol.78, no.9, p.5287-92 (1 May 1983).
A systematic study of the polarizability and polarizability derivatives of N_2 is undertaken as a function of basis set and level of correlation treatment. The value obtained for the ratio of derivatives ($r_e\beta'_e/\beta_e$) of the polarizability anisotropy $\beta=\alpha_{\parallel}-\alpha_{\perp}$ is 3.15±0.2, which is larger than the two experimental estimates of 2.63±0.29 and 2.22±0.44. (33 refs.)

65996 Resonance Rayleigh scattering of cyanine dyes in solution. J.Anglister, I.Z.Steinberg (Dept. of Chem. Phys., Wiezmann Inst. of Sci., Rehovot, Israel).

J. Chem. Phys. (USA), vol.78, no.9, p.5358-68 (1 May 1983).

Every process of light absorption is inherently associated with a resonance scattering of the incident beam regardless of the nature of the absorbing molecules. Both the real and imaginary parts of the refractive index contribute to the resonance scattering, and marked depolarization is expected to be observed as a rule in the light scattered by complex molecules. The resonance and near-resonance Rayleigh scattering has been measured for a number of cyanine dyes: pseudocyanine, orthochrome T, 1,1'-diethyl-2,2'-pyridyl-quinolyl cyanine, and pinacyanol chloride, in a number of solvents. In no case was the measured scattering intensity weaker than that expected theoretically, and good agreement between theory and experiment was found as a rule at the blue part of the absorption bands. In contrast, the measured scattering intensities exceeded (by up to fourfold) the theoretically expected values as the red parts of the absorption bands. Possible reasons for this discrepancy are discussed. (19 refs.)

65997 Vibrational spectra and normal coordinate analysis of *p*-bis(dimethyl-hydroxy-silil)benzene-d_0 and $-d_4$. G.Sbrana, N.Neto (Centro di Studio sullar Chimica e la Struttura dei Compositi Eterociclici, CNR, Firenze, Italy), M.Muniz-Miranda, M.Nocentini.

Spectrochim. Acta Part A (GB), vol.39A, no.4, p.295-303 (1983).

The IR and Raman spectra of *p*-bis(dimethyl-hydroxy-silil)tetradeuterobenzene have been obtained and compared with data of the corresponding normal compound. Complete normal mode calculations of both -d_0 and $-d_4$ derivatives have been carried out using a set of valence force constants transferred from suitable molecules and refined to account for the observed IR and Raman data. Results of a model calculation, in which substituents are considered as point masses, are also discussed in order to provide a convenient stating point to study the chain conformation of a polymer obtained through polycondensation of the investigated molecule. (10 refs.)

65998 Thermal molecular beam matrix spectroscopy of cyclobutanol: temperature dependence of lineshapes and the conformation problem. R.Gunde, H.Gunthard (Lab. of Phys. Chem., Swiss Federal Inst. of Technol., Zurich, Switzerland).

Spectrochim. Acta Part A (GB), vol.39A, no.4, p.315-26 (1983).

Thermal molecular beam spectra of cyclobutanol isolated in Ar and Xe matrices and the temperature dependence of the ν(OH) Raman line are reported. Six matrix bands are shown by lineshape analysis to consist of 4-6 components which systematically decrease and increase with increasing temperature of the molecular beam source. Data on lineshape parameters and relative intensities are reported. Likewise the ν(OH) Raman band is shown to consist of four components which behave with respect to temperature dependence analogously to the matrix bands. The results will be discussed in terms of two models. (23 refs.)

65999 Raman and IR studies of the antileprotic drug Dapsone. R.D'Cunha, V.B.Kartha (Spectroscopy Div., Bhabha Atomic Res. Centre, Bombay, India), S.Guranini.

Spectrochim. Acta Part A (GB), vol.39A, no.4, p.331-6 (1983).

No information is availabe on the mode of action of Daspone (4,4-diamino,diphenyl sulphone) in leprosy treatment, the phenomena of drug resistance and toxicity. Information on the interaction of Dapsone with serum proteins can be obtained at the molecular level by spectroscopic investigations on structural changes of the system. As a first step in these investigations, the IR and laser Raman spectra of Dapsone and *N*-deutero Dapsone have been obtained. The characteristic vibrational frequencies of the NH_2 group the SO_2 group and the aromatic ring have been identified and assigned from isotope shifts and studies in various solvents. (11 refs.)

Anomalous rotational state distribution for the O_2 photofragment in the UV photodissoication of ozone .... See Entry 65945

Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate .... See Entry 65967

Infrared and Raman study of the interaction between methyl acetate and phenol derivatives .... See Entry 65973

Infrared & Raman Spectra of vanillin .... See Entry 65974

Infrared and Raman study and ab initio calculations of internal rotation in methylisopropenyl ether .... See Entry 65984

Vibrational spectra, isolated CH stretching frequencies and CH bond lengths in CH_3OCH_2X compounds (X=F, Cl, Cr, I) .... See Entry 65987

Molecular structure, vibrational spectra and normal coordinate analysis of S-methyl dithiocarbamate .... See Entry 65988

Vibrational spectra and rotational isomerism of 1,2-dimethyldisilane .... See Entry 65992

Molecular constants and thermodynamic properties of some planar XY_3-type molecules .... See Entry 66157

Coherent anti-Stokes Raman spectroscopy of water vapor of combustion diagnostics .... See Entry 66670

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 .... See Entry 66953

Novel features in the stereochemistry of octacyanides: phase transition in tetra-n-butylammonium octacyanotungstate(V) .... See Entry 68191

Intramolecular vibrations in ICE. Interpretation of experiments on the isotopic isolation of H_2O molecules .... See Entry 68204

The role of C=O transition dipole-dipole coupling interaction in uracil .... See Entry 68232

Normal coordinate analysis treatment on uracil in solid state .... See Entry 68233

Ethylene on silver: development of surface enhanced Raman lines with exposure .... See Entry 68238

33.20K Visible spectra

66000 Electronic absorption and emission studies of the Group IIIA metal suboxides isolated in cryogenic rare gas matrices. M.A.doublas, R.H.Hauge, J.L.Margrave (Dept. of Chem., Univ. of Texas, Houston, TX, USA).

High Temp. Sci. (USA), vol.16, no.1, p.35-54 (Feb. 1983).

Electronic absorption and emission studies of matrix-isolated M_2O (M=Al, Ga, and In) have been used to characterize three electronically excited states for each of these molecules. Experimental evidence suggests that the B states have a different spin multiplicity than the ground states. In absorption, progressions in the symmetric stretching and bending modes are observed for the $A \leftarrow X$ and $C \leftarrow X$ systems of one or more of the metal suboxides. The $C \rightarrow X$ emission system for Al_2O exhibits a ground state progression in the symmetric stretching mode, which is established as 471 ± 15 cm^{-1}. Ground state Al_2O is linear or very nearly so, consistent with previous thermochemical and mass spectrometric studies of Al_2O. (25 refs.)

66001 Spectrophotometric study of some praseodymium mixed ligand complexes in different environments. M.P.Bhutra, A.K.Gupta (Dept. of Phys., Univ. of Jodhpur, Jodhpur, India).

Indian J. Pure & Appl. Phys., vol.20, no.12, p.954-7 (Dec. 1982). [received: April 1983]

Absorption spectra of four praseodymium complexes in water, formamide and dimethylsulphoxide have been recorded in the region 360-650 nm. Various energy, bonding and intensity parameters have been calculated. The effects of various ligands on the position and intensity of the observed transitions in different environments, have been discussed in terms of metal-ligand coordination. It has been observed that the intensity of ${}^3P_2 \leftarrow {}^4H_3$ transition varies with the covalency of the complexes. (20 refs.)

66002 Kinetic study of the $KrXe^+$ heteronuclear ion emission. P.Millet, A.Birot, H.Brunet, M.Espagnan, J.Galy, Y.Salmero (Centre de Phys. Atomique, Univ. Paul Sabatier, Toulouse, France).

J. Phys. B (GB), vol.16, no.8, p.1383-92 (28 April 1983).

The emission spectra of KrXe mixtures were plotted at different total pressures and at xenon concentrations varying from 0.5 to 99%. A characteristic emission of the mixture was seen at 490 nm, it appeared as soon as possible as the mixture contained 0.5% xenon. The emission at 490 nm has a maximum intensity at a xenon concentration of 20%. The shape of the light pulses obtained for this transition is described by an exponential decay with a time constant corresponding to the formation of the radiative state. The $KrXe^+$ ion involved is the $IV^1/_2$ state; the kinetic scheme given defines the role and the value of the various reaction rate constants. (11 refs.)

66003 Spectra of the ammonium radical: the Schuster band of ND_4. G.Herzberg (Nat. Res. Council of Canada, Ottawa, Ontario, Canada), J.T.Hougen.

J. Mol. Spectrosc. (USA), vol.97, no.2, p.430-40 (Feb. 1983).

The Schuster band of ammonia occurs in many kinds of electric discharges through streaming ammonia if the pressure is not too low. While it is entirely diffuse for ordinary ammonia it shows a fairly clear structure (and an isotope shift) when produced with heavy ammonia (ND_3). Studies with intermediate isotopes show conclusively that there are four H atoms and a single N atom present in the molecule responsible for this spectrum, i.e. that it is due to the ammonium (NH_4) radical. An attempt is made to understand the structure of the ND_4 Schuster band in terms of a tetrahedral configuration of the molecule in both upper and lower state. By assuming that the lower state is the (predissociating) ground-state $3s^2A_1$ of the molecule while the upper state is a ${}^2F_2$ state derived from a $3d$ electron it is possible to obtain quite a fair and detailed representation of the observed structure including partly resolved tetrahedral splittings in the upper state. The agreement of the wavenumber of the band origin with several recent ab initio calculations is not as good as one might wish and not as good as in the analogous case of H_3. This and other difficulties of the present interpretation of the spectrum are briefly discussed. (27 refs.)

Rotational analysis and deperturbation of the $C^2\Sigma^+$-$X^2\Sigma^+$ band systems of BeH and BeD .... See Entry 65944

Rotational analysis of the (0-3) band in the 3*A* system of ${}^{14}C^{16}O$ .... See Entry 65958

Highly resolved electronic spectra and electronic structure of benzo[f]quinoxaline .... See Entry 66059

$B^1\Pi$-$X^1\Sigma$ and $C^1\Sigma$-$X^1\Sigma$ electron-transition strengths of the SrO molecule .... See Entry 66076

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 .... See Entry 66953

33.20L Ultraviolet spectra

66004 Observation by laser ionization spectroscopy of vibrationally excited nitric oxide following $O({}^1D_2)+N_2O \rightarrow 2NO$. N.Goldstein, G.D.Greenblatt, J.R.Wiesenfeld (Dept. of Chem., Baker Lab., Cornell Univ., Ithaca, NY, USA).

Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.410-12 (15 April 1983).

Nitric oxide in $v'' \leq 11$ has been detected using one-photon resonant laser ionization spectroscopy following the reaction of electronically excited oxygen atoms with nitrous oxide. The nascent rotational distribution appears to differ significantly from that observed to 300K. (9 refs.)

66005 Two-photon absorption study of Zn(II)tetraphenylporphin: role of a higher excited singlet state of gerade symmetry. S.Tobita, I.Tanaka (Dept. of Chem., Tokyo Inst. of Technol., Tokyo, Japan).

Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.517-21 (22 April 1983).

The S_2 state fluorescence of Zn(II)tetraphenylporphin has been studied by using two-photon absorption and optical-optical double-resonance techniques. The main process to populate the S_2 state was found to be a stepwise two-photon absorption to the S_n state through the S_1 state. The large absorption cross section of the $S_n \leftarrow S_1$ transition (6.8×10^{-16} cm^2 molecule^{-1}) at 540 nm suggests that there exists a higher excited singlet state of gerade parity. (18 refs.)

66006 Analysis of the 254.7 nm absorption system of carbonyl fluoride. R.H.Judge, D.C.Moule (Dept. of Chem., Brock Univ., St. Catharines, Ontario, Canada).

J. Chem. Phys. (USA), vol.78, no.8, p.4806-10 (15 April 1983).

The 230 nm absorption spectrum of carbonyl fluoride has been recorded in the vapor phase at 25° and −78°C at path lengths up to 48 m. In all, 170 bands were observed in the spectrum and were assigned to vibrational activity in ν_1', ν_2', ν_3', ν_4', and ν_5'. The presence of temperature sensitive bands attributed to ν_4'' lead to the interpretation that the excited state is nonplanar. Combination differences isolating ν_4'' show that the inversion doubling splitting is less than the experimental error for levels 4^+ and 4^- in the Q_4 mode of vibrational excitation. A fit of the G_4 term values to the energy levels derived from a quadratic-Lorentzian function yielded a central barrier of 8200 cm^{-1} and an out-of-plane angle of 31.8° for $V(Q_4)$. The high barrier is attributed to an inductive effect from the fluorine atoms brought about by a relaxation of the symmetry from C_{2v} to C_s on electronic excitation. (15 refs.)

66007 UV absorption spectra of vibrationally highly excited toluene molecules. H.Hippler, J.Troe, N.J.Wendelken (Inst. fur Phys. Chem., Univ. Gottingen, Gottingen, Germany).

J. Chem. Phys. (USA), vol.78, no.9, p.5351-7 (1 May 1983).

Vibrationally highly excited toluene molecules with an energy of 52000 cm^{-1} have been prepared by UV laser excitation and subsequent iosmerization of the isomer cycloheptatriene. The UV absorption spectrum of the toluene, whose vibrational energy would correspond to the average energy of thermal molecules at 2800K, has been measured over the range 210-270 nm. It is compared with the UV spectrum of thermal molecules heated in shock waves up to 1800K. All spectra, corresponding either to microcanonical or canonical energy distributions, can be represented by a modified Sulzer-Weiland equation. It is concluded that the absorption coefficients can be expressed to a first approximation by the average energy of the excited molecules independent of their energy distribution. (20 refs.)

Rotational analysis and deperturbation of the $C^2\Sigma^+$-$X^2\Sigma^+$ band systems of BeH and BeD ....See Entry 65944

Electronic absorption and emission studies of the Group IIIA metal suboxides isolated in cryogenic rare gas matrices ....See Entry 66000

Spectrophotometric study of some praseodymium mixed ligand complexes in different environments ....See Entry 66001

Highly resolved electronic absorption and luminescence spectra of some phenanthrolines in Shpolskii matrices. II. Fluorescence and $S_1 \leftarrow S_0$ absorption spectra ....See Entry 66060

Constant of the second O_g^+ ion-pair state of I_2 ....See Entry 66093

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 ....See Entry 66953

33.20R X-ray spectra

66008 Use of X-ray spectra to determine the semiempirical parameters of 4d transition metals. A.A.Voityuk (Inst. of Inorganic Chem., Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.355-9 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.37-42 (May-June 1982). [received: Feb. 1983]
The possibility of using X-ray emission spectra to calibrate the parameters used in semiempirical methods for calculating the electronic structures of molecules has been examined. A relationship has been found between the position of the level of a metal α_M and the value of the resonance parameter β_{ML} on the one hand, and the X-ray spectral parameters on the other. The experimental spectra of the metals in octahedral complexes of Pd, Rh, and Ru have been used to obtain the values of the parameters of these metals. The relationship between the profile of the X-ray spectrum and the charge on the metal atom in analogous compounds has been analyzed. The experimental FK_α and ClK_β spectra of the complexes $[ML_6]$, where L=F or Cl, have been used to find the value of the parameters of the ligand-ligand resonance interaction. (21 refs.)

66009 Change in the electronic structure of the thiocyanate ion on coordination. L.N.Mazalov, A.A.Voityuk, G.K.Parygina (Inst. of Inorganic Chem., Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.364-8 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.48-53 (May-June 1982). [received: Feb. 1983]
A quantum-chemical and X-ray spectral study of the redistribution of electron density in the SCN^- on coordination has been carried out. It has been established that the profile of the X-ray SK_β-spectrum of a complex containing the thiocyanate group is related unambiguously to the mode of coordination of the ligand. An analysis of the change in the strength of the S-C and C-N bonds in the thiocyanate groups has been carried out. It has been shown that calculations of the electronic structure of model molecules give the principal changes in the electron density distribution in the ligand on coordinate bond formation. (13 refs.)

66010 Electronic structure of benzene studied in USX emission. J.Nordgren, L.Selander, L.Pettersson, R.Brammer, M.Backstrom, C.Nordling (Inst. of Phys., Uppsala Univ., Uppsala, Sweden), H.Agren.
Phys. Scr. (Sweden), vol.27, no.3, p.169-71 (March 1983).
A high resolution Ultra Soft X-ray (USX) emission spectrum of gaseous benzene has been recorded. The spectrum is interpreted by means of ab initio one-center intensities and electron spectroscopic data. A comparison is made with USX spectra of solid benzene showing a uniform shift towards higher photon energies for the gas phase spectrum. The solid and gas phase USX spectra show quite different satellite structure which is interpreted in terms of photon and electron excitation of spectra. (25 refs.)

X-ray spectral study of the electronic structure of organic four-and five-coordinated silicon derivatives ....See Entry 66027

Shape resonance phenomena in CO following *K*-shell photoexcitation ....See Entry 66067

X-ray structure study of a pyrazolino-cepham (VPNB) $C_{24}H_{23}NB_5O_7S$ ....See Entry 66151

Multiple-scattering effects in EXAFS spectroscopy of oxygen-bridge iron complexes. Possibility of angle determination by EXAFS analysis ....See Entry 68359

33.25 NUCLEAR MAGNETIC RESONANCE AND RELAXATION; NUCLEAR QUADRUPOLE RESONANCE (NQR)

66011 Transmission of spin-spin coupling constants through different paths in bicyclo(2,2,1)heptane: their calculation using inner projections of the polarization propagator. G.E.Scuseria, J.C.Facelli, R.H.Contreras, A.R.Engelmann (Dept. de Fisica, Univ. de Buenos Aires, Buenos Aires, Argentina).
Chem. Phys. Lett. (Netherlands), vol.96, no,5, p.560-2 (22 April 1983).
Inner projections of the polarization propagator are used to calculate components of the Fermi contact interaction between protons attached to the bridgehead carbon atoms of bicyclo(2,2,1)heptane. Four- and five-bond paths and through-space interaction are considered. Reasonable path additivity and agreement with experimental data are found at the INDO level. (15 refs.)

66012 A ^{11}B NMR study of 5,6-dicarba-nido-decaborane (12). B.Stibr, S.Hermanek, Z.Janousek, Z.Plzak, J.Dolansky, J.Plesek (Inst. of Inorganic Chem., Acad. of Sci., Prague, Czechoslovakia).
Polyhedron (GB), vol.1, no.11-12, p.822-4 (1982).
Final assignment of all eight signals in the ^{11}B NMR spectrum (64.2 MHz) of 5,6-dicarba-nido-decaborane (12) is reported on the basis of its substituted derivatives. (10 refs.)

66013 On the estimation of relaxation contributions to internal motion. H.Sterk, E.Bittersmann (Inst. fur Organische Chem., Univ. Graz, Graz, Austria).
J. Mol. Liq. (Netherlands), vol.25, no.1, p.39-50 (March 1983). In German.
Spin-lattice T1 and spin-spin T2 relaxation times of primary and tertiary amines were investigated by two different models (Woessner 1969 (a), Jardetzky 1980 (b)). It is shown that the internal diffusion constants D_i of the alkylchains can be well described by D_i^o and a formal rotational barrier. The overall correlation times determined from different independent T1 and T2 measurements are in excellent agreement. The weighted frequencies of motion λ_i of model (b) correlate to the D_i and D_o of model (a). (9 refs.)

66014 PMR spectra of some substituted pyrazines and 2,3-dihydropyrazines. J.Chellappa, K.Pandiarajan, T.Rangarajan (Dept. of Chem., Annamalai Univ., Annamalainagar, India).
Indian J. Chem. B, vol.21B, no.8, p.778-9 (Aug. 1982). [received: April 1983]
PMR spectra of 2, 5, 6-triphenyl-2, 3-dihydropyrazine (Ia), 2-alkyl-3, 5, 6-triphenyl-2, 3-dihydropyrazines (Ib-d) and the corresponding pyrazines (IIa-d) reveal that dihydropyrazines (I) are not planar and the dihedral angle about the C_2-C_3 bond in the ring is close to 60°. Effect of alkali groups on the chemical shift of the benzylic proton of I has been discussed. Further, alkyl groups inhibit the resonance interaction between the phenyl group and the pyrazine ring. (6 refs.)

66015 Mechanism of T_1 relaxation in ^{13}CO complexed to an iron porphyrin: implications for CO bonding in heme proteins. T.Perkins (Dept. of Chem., California Inst. of Technol., Pasadena, CA, USA), J.D.Satterlee, J.H.Richards.
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1350-4 (9 March 1983).
Chemical shifts and spin-lattice relaxation parameters for ^{13}CO bonded to the complex 1-methylimidazole-iron protoporphyrin dimethyl ester are reported. The ^{13}CO chemical shifts are much different from those observed in the carbonyl vertebrate hemoglobins, but remarkably similar to that observed for the monomeric hemoglobin component from Glycera dibranchiata. The relaxation parameter, T_1, is shown to change dramatically upon ligation to both the hemin model system and to hemoglobin A. The mechanisms of spin-lattice relaxation are dominated by chemical shift anisotropy for ^{13}CO bound to both hemins and proteins, but, in the latter, dipole-dipole forces make an additional contribution to the overall relaxation rate. (40 refs.)

66016 Vibrationally averaged structure of azulene partially oriented in a nematic phase. A.D.Hunter, E.E.Burnell (Dept. of Chem., Univ. of British Columbia, Vancouver, BC, Canada), T.C.Wong.
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.159-64 (May 1983).
The NMR spectrum of azulene partially oriented in a nematic phase has been measured, and the geometry of the proton skeleton and the values of the indirect spin-spin coupling constants determined. The results, after correcting for the effects of molecular vibrations, are combined with electron diffraction data to yield the molecular structure. Within one degree, all CH bonds bisect CCC angles. (12 refs.)

66017 Interpretation of lanthanide-induced shifts in NMR spectra. The case of nonaxial symmetry. T.A.Babushkina, V.F.Zolin, L.G.Koreneva (Inst. of Radioengng. & Electronics, Acad. of Sci., Moscow, USSR).
J. Magn. Resonance (USA), vol.52, no.2, p.169-81 (April 1983).
The approach to the treatment of low-symmetry systems by the method of lanthanide shift reagents (LSR) is considered. Analysis of the results obtained by optical spectroscopy (mostly by luminescence spectroscopy of Eu^{3+} ion) is used for this purpose. From the spectra mentioned, a model of the LSR adduct and parameters describing anisotropy of magnetic susceptibility are obtained. The method is applied to several rare-earth complexes of nonaxial symmetry. Bleaney's theory (1972) connecting pseudocontact NMR shifts to crystal field parameters of the second order is verified and shown to be correct if the crystal field splittings are of the order of kT. The systems $Ln(dpm)_3$ and $Ln(fod)_3$ are discussed. (36 refs.)

66018 Solvent dependence of deuteron quadrupole coupling constants and of methyl angles of some CD_3X compounds determined by NMR of partially oriented molecules. J.Jokisaari, P.Diehl, J.Amrein (Dept. of Phys., Univ. of Basel, Basel, Switzerland), E.Ijas.
J. Magn. Resonance (USA), vol.52, no.2, p.193-201 (April 1983).
The deuteron quadrupole coupling constants, Q_D, and methyl angles of the solute molecules CD_3CN, CD_3Br, CD_3I, and CD_3NO_2 were determined in various liquid-crystal solvents by use of NMR spectroscopy of oriented molecules. Carbon-13 satellites at natural abundance in the ^{2}H or ^{1}H spectra were used for the measurement of the degree of order of the C-D bonds. The results reveal a strong solvent dependence of Q_D (maximum variation of 26% in CD_3NO_2) as well as of the DCD angle (maximum variation of 2.3 degrees in CD_3I). These large apparent effects are attributed to much smaller real variations occurring in a two-site interaction. A general correlation between increasing anisotropy of the solvent diamagnetic susceptibility, decreasing Q_D, and increasing DCD angle is observed. (21 refs.)

66019 Structure and orientation of propargyl chloride partially oriented in a nematic mesophase. E.E.Babcock, J.H.Goldstein (Dept. of Chem., Emory Univ., Atlanta, GA, USA).
J. Magn. Resonance (USA), vol.52, no.2,. p.247-53 (April 1983).
The proton nuclear magnetic resonance spectra, including ^{13}C satellites at natural abundance, of propargyl chloride partially oriented in a nematic phase were analyzed. The direct coupling constants obtained were corrected for harmonic vibrations and used to calculate geometrical and orientational information. A variation in the temperature at which the NMR spectra were recorded had a negligible effect upon the structure. The difference between the vibrationally uncorrected and corrected distance ratios is substantial. (21 refs.)

66020 Cadmium-113 NMR spin-lattice relaxation and exchange kinetics in Concanavalin A: A double saturation transfer experiment. P.D.Ellis, P.P.Yang, A.R.Palmer (Dept. of Chem., Univ. of Southern Carolina, Columbia, SC, USA).
J. Magn. Resonance (USA), vol.52, no.2, p.254-66 (April 1983).
The fields dependence of the 113Cd relaxation rate in cadmium-substituted Concanavalin A was investigated at three magnetic field strengths, 2.3, 4.7, and 9.4 T. Because of the anomalously large relaxation rate observed for the resonance corresponding to free cadmium in the system and the authors' prior knowledge that cadmium is undergoing chemical exchange in this system, a detailed analysis was undertaken of the relaxation data obtained at 9.4 T to investigate the relative importance of chemical exchange dynamics upon the observed relaxation time constants. The differential equations for the resulting restricted three-site exchange network can be solved in closed form by employing a double saturation transfer experiment in conjunction with a saturation-recovery T_1 experiment. The analysis of these data demonstrate that chemical exchange processes contribute 14, 75, and 20% to the observed relaxation time constants for the ^{113}Cd resonances for the SI site, free cadmium and the S2 site respectively. If the possibility of exchange contributions to the NOE were ignored, then the observed field dependence of T_1 could not be discussed in terms of conventional single correlation time theories of relaxation. In this case the data could be discussed in terms of correlation times involving overall motion of the protein coupled with correlation times describing 'internal motions'. These internal motions may be the result of the formation of 'abortive' complexes with exogenous ligands for those metalloproteins where the metal can be readily removed from the protein. However, for Con A, it is shown that the weak field dependence observed for the

heteronuclear NOE is not due to internal motions, but rather to exchange processes. (17 refs.)

66021 **2D correlation spectroscopy in homonuclear dipolar-coupled solids.** N.Schuff, U.Haeberlen (Max-Planck-Inst. fur Medizinische Forschung, Heidelberg, Germany).

J. Magn. Resonance (USA), vol.52, no.2, p.267-81 (April 1983).

A novel 2D proton solid-state NMR experiment is described in which the spins evolve freely during the evolution period, while they are decoupled from each other by a multiple-pulse sequence in the detection period. The resulting 2D spectrum allows the correlation of chemical shifts with dipolar interactions. It is useful for assigning proton chemical shift tensors and for recording simplified wide-line spectra whose meaning is discussed in terms of a 'gedanken' experiment. The method is applied to a single crystal of malonic acid (MA). The long-standing problem of assigning the previously measured proton chemical shift tensors in MA to the proton sites is solved. For the first time line splittings are resolved which result from dipolar interactions of the carboxylic protons in MA. They are discussed in terms of the geometry of the hydrogen bonds formed by these protons. (13 refs.)

66022 **Calculation of transverse relaxation times from lineshapes modified by Gaussian-exponential filtering.** G.Braoudakis (Dept. de Statistique et Informatique Medicales, Inst. de Medicine Sociale et Preventive, Univ. de Lausanne, Lausanne, Switzerland), I.P.Gerothanassis, J.Lauterwein.

J. Magn. Resonance (USA), vol.52, no.2, p.288-92 (April 1983).

The authors present a simple computer-aided way to evaluate T_2 values from lineshapes modified by the Gaussian-exponential filtering. (15 refs.)

66023 **How restricted are partially restricted MO calculations? A few comments on the calculations of spin-spin coupling pathways at the INDO/FPT level.** R.Laatikainen (Dept. of Chem., Univ. of Manitoba, Winnipeg, Manitoba, Canada).

J. Magn. Resonance (USA), vol.52, no.2, p.293-8 (April 1983).

While standard FPT/INDO MO calculations are widely used, and are sometimes useful in the prediction of conformational or structural behavior of spin-spin couplings, a more detailed and informative picture can be obtained if the total coupling is divided into π, σ, TS (through space), and other specific contributions. The history of the calculations was reviewed by Kowalewski (1977). Recently, Engelmann et al. (1981) and Fukui et al. (1981, 1982) developed the PRMO and SOS2 methods. The NNBI procedure, especially useful in the calculation of TS contributions, was described by Barfield (1980). Attempts to apply PRMO to the interpretation of TS components of several H-H, H-F, and H-C couplings, and some important differences found betwen PRMO and NNBI results, led to the calculations described. The author points out that when the TS contribution is computed by the PRMO method, setting some atomic orbitals to be restricted, the contribution so obtained may often contain a large component due to the change in the spin polarizability near the perturbed nuclei. A few examples are discussed, PRMO and NNBI methods are compared, and the meaning of the π contribution is briefly discussed. (9 refs.)

66024 **^{13}C shift anisotropies in polycrystalline calcium formate.** R.Richarz (Varian Ltd., Zug, Switzerland), H.Sauter.

J. Magn. Resonance (USA), vol.52, no.2, p.308-9 (April 1983).

Experiments on solid samples are a convenient source of anisotropic NMR parameters. With the advent of magic-angle spinning high-resolution spectra of polycrystalline material can be obtained. If the rotation is not fast compared to the anisotropy of the chemical shift, spinning side bands appear, from which the anisotropies can be extracted. (2 refs.)

66025 **The use of dimethyl selenide as a chemical shift reference in ^{77}Se NMR spectroscopy.** N.P.Luthra, R.B.Dunlap, J.D.Odom (Dept. of Chem., Univ. of Southern Carolina, Columbia, SC, USA).

J. Magn. Resonance (USA), vol.52, no.2, p.318-22 (April 1983).

In recent years the utility of ^{77}Se NMR spectroscopy in the study of inorganic, organic, and biological systems has been demonstrated. Selenium-77 is a spin-1/2 nucleus and offers adequate natural abundance (7.5%) and relative receptivity (5.26×10^{-4} with respect to ^{1}H and 2.98 with respect to ^{13}C) as well as a large chemical shift range ~2800 ppm; extremes are 1-thia-3,3,5,5-tetramethyl-4-cyclohexanselone (2135 ppm) and disilyl selenide (−666 ppm). Moreover, the resonance of the ^{77}Se nucleus is extremely sensitive to its electronic environment. (23 refs.)

66026 **Multiplet selection using multiple quantum coherence.** P.J.Hore, R.M.Scheek, R.Kaptein (Dept. of Phys. Chem., Univ. of Groningen, Groningen, Netherlands).

J. Magn. Resonance (USA), vol.52, no.2, p.339-42 (April 1983).

Among the various methods devised to combat the nuisance of overcrowded NMR spectra, there are number which involve the excitation and detection of multiple-quantum (MQ) coherence. These techniques exploit MQ phase and precession properties to limit the information content of an NMR spectrum and thereby improve resolution. Thus, MQ NMR has been used to remove quadrupolar splittings, to reduce the spectral complexity of molecules oriented in liquid crystals, and for the selection of multiplets. An elegant example of the latter is a method of tracing the carbon skeleton of an organic molecule via the ^{13}C-^{13}C scalar couplings. Suppression of the strong singlet resonances from isolated ^{13}C nuclei is accomplished by preparing and selectively detecting double-quantum coherence between pairs of coupled ^{13}C spins. A recent modification of this experiment attained a higher level of simplificaiton of ^{1}H spectra by eliminating not only all singlets but also all multiplets other than the two doubles from a preselected pair of coupled spins. The method, referred to a DOUBTFUL, has been applied successfully to cytosine H5, H6 protons in a fragment of *lac* operator DNA. One cannot excite N-quantum coherence in a molecule with fewer than N coupled spins-$^{1}/_{2}$; selective detection of N-quantum coherence therefore filters out the smaller spin systems leaving only those with $\geq N$ nuclei. For this purpose it is generally desirable to use the highest quantum coherence possible in the spin system of interest. The authors describe an extension of the double-quantum DOUBTFUL idea to triple-quantum coherence. The experiment is designed to detect isolated three-spin systems in ^{1}H NMR spectra that are complicated by spectral overlap. For example, in protein NMR spectra ABX or AMX spin systems occur for the $C_{\alpha}H$-$C_{\beta}H_2$ groups in the amino acid residues, Asn, Asp, Cys, His, Phe, Ser, Trp, and Tyr and specific detection of these spin systems could be very valuable. (23 refs.)

66027 **X-ray spectral study of the electronic structure of organic four-and five-coordinated silicon derivatives.** S.G.Shevchenko, V.P.Elin, G.N.Dolenko, V.P.Baryshok, V.P.Feshin, Yu.L.Frolov, L.N.Mazalov, M.G.Voronkov (Inst. of Inorganic Chem., Acad. of Sci., USSR).

J. Struct. Chem. (USA), vol.23, no.3, p.360-4 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.43-7 (May-June 1982). [received: Feb. 1983]

The chemical shifts of the Si$K\alpha$ and C1$K\alpha$ lines have been determined. They have been used to obtain the Pauling charges on the silicon and chlorine atoms in silatrane molecules of the type $XSi\ (OCHRCH_2)_{3-n}(OCH_2CH_2)_nN$ (R=H, CH$_3$, n=0-3), the corresponding Si-substituted derivatives of triethoxysilane $XSi(OCH_2CH_3)_3$ (X=H, Cl, CH$_3$, ClCH$_2$), and the heterocyclic compounds $(CH_3)_2Si(OCH_2CH_2)_2Y$, where Y=O, CH$_3$N, and $(CH_3)_2Si(OCH_2CH_3)_2$. It has been shown that increase in the coordination number of the silicon atom leads to an increase in its positive charge, and that this increase may be reduced by N→Si interaction. (19 refs.)

66028 **Quantum-chemical calculation of NMR chemical shifts.** P.V.Schastnev, A.A.Cheremisin (Inst. of Chem. Kinetics & Combustion, Acad. of Sci., USSR).

J. Struct. Chem. (USA), vol.23, no.3, p.440-62 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.139-70 (May-June 1982). [received: Feb. 1983]

The present review deals with various aspects of the problem of chemical shift and nonempirical and semi-empirical methods of calculation. Most attention is paid to questions of fundamental importance and to the discussion of methods which are promising from the viewpoint of application to molecules with fairly large dimensions, most important at the present time. (178 refs.)

66029 **Nuclear magnetic resonance studies of transition-metal complexes of ethylenediaminetetra-acetic acid (EDTA) in aqueous solution.** J.Oakes, E.G.Smith (Port Sunlight Lab., Unilever Res., Bebington, England).

J. Chem. Soc. Faraday Trans. I (GB), vol.79, no.2, p.543-52 (Feb. 1983).

The structures of EDTA complexes of transition-metal ions in aqueous solution have been investigated by NMR. Whereas complexes with Fe^{3+} and Mn^{2+} possess a single water molecule in their coordination spheres, the coordination number of water in complexes of Co^{2+}, Ni^{2+} and Cu^{2+} are 0.19, 0.33 and 0.38, respectively. These are interpreted in terms of a dynamic equilibrium between two complexes one containing hexa-coordinate EDTA and the other penta-coordinate EDTA. It appears that the predominant solution structures adopted by these complexes are similar to those determined for the crystals. Although the coordinated water becomes replaced by a hydroxyl group for the EDTA complex of Fe^{3+} above pH 7, this did not occur for complexes of divalent ions below pH 10. (26 refs.)

66030 **^{31}P NMR study of the inclusion of organophosphorus molecules in cyclodextrins.** Bo-Long Poh (School of Chem. Sci., Univ. Sains Malaysia, Penang, Malaysia), W.Saenger.

Spectrochim. Acta Part A (GB), vol.39A, no.4, p.305-7 (1983).

The upfield shift of the ^{31}P NMR signal of diethylethylphosphonate and dimethylphenylphosphine oxide in the presence of cyclodextrins in water is interpreted in terms of inclusion complex formation between the cyclodextrins and the organophosphorus molecules. The P=O group is closer to the solvent medium than to the interior of the hydrophobic cavity of the cyclodextrins in the complexes studied. (14 refs.)

Stimulated echo NMR spectra and their use for heteronuclear two-dimensional shift correlation ....See Entry 64924

Nuclear magnetic resonance flip-angle effects: observability of multipole operators ....See Entry 64928

A simple method for simultaneous homo- and heteronuclear decoupling on FT-NMR spectrometers ....See Entry 64929

Heteronuclear zero quantum spectroscopy as a conformational probe ....See Entry 64933

Determination of heteronuclear coupling constants via semiselective two-dimensional *J* spectroscopy ....See Entry 64934

An improved sequence for broadband decoupling: WALTZ-16 ....See Entry 64935

Theory of magnetic susceptibilities and NMR chemical shifts in terms of localized quantities. III. Application to hydrocarbons and other organic molecules ....See Entry 65864

Comment on ab initio calculation of spin densities in hydrocarbon radicals ....See Entry 65868

INDO-MO study of δ-CH acetyl-proton couplings in aliphatic α-acetoxy radicals ....See Entry 65884

A polynomial fitting procedure for the determination of the moments of NMR lines in polymers from the truncated FID ....See Entry 66156

Proton NMR and dielectric relaxations in some phenolic Mannich bases ....See Entry 68059

33.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

66031 **Structure and photodecomposition reactions of cations of cyclopentane, cyclohexane, cyclic olefines and dienes in γ-irradiated frozen solutions of CF_3CCl_3. An ESR study.** M.Tabata, A.Lund (Studsvik Sci. Res. Lab., Nykoping, Sweden).

Chem. Phys. (Netherlands), vol.75, no.3, p.379-88 (15 March 1983).

ESR studies of cyclopentane, cyclohexane, cylopentene, cyclohexene, 1,4- and 1,3-cyclohexadiene cations have been performed in order to elucidate their structures and their reactions, particularly those induced by visible light. The cations were generated by irradiation at 77K of the solutes contained in a CF_3CCl_3 matrix. At low temperature (6K) to the cylopentane cation has a low (C_s) symmetry characterized by $a=22.4$ G (2H). At higher temperature (113K) all ten hydrogens interact equally with $a=6.3$ G. The cyclohexane cation has $a=43$ G (6H) at 141K characteristic of a chair form with $\rho=0.085$ on each of the six equatorial hydrogen atoms. The cyclohexane cation undergoes a dehydrogenation reaction under the action of visible light resulting in the formation of the cyclohexene cation. New reaction mechanisms are proposed for this case and for the decomposition of the unsaturated hydrocarbon cations under study. (19 refs.)

66032 **Further measurement and analysis of lines in the LMR spectrum of HCO at 5.3 μm.** I.M.Brown, K.Dumper (Southampton Univ., Southampton, England), R.S.Lowe.

J. Mol. Spectrosc. (USA), vol.97, no.2, p.441-8 (Feb. 1983).

Lines in the infrared spectrum of the HCO radical have been studied previously by laser magnetic resonance (LMR) spectroscopy at wavelengths of 5 μm (Brown et al., 1980) and 10 μm (Jones et al., 1977). There are two fundamental bands involved, the CO stretch ν_2 and the bending vibration ν_3, respectively. Parts of the shorter wavelength spectrum in particular were very congested and it was not possible to make detailed assignments in such regions. The authors report new observations and revised measurements of the 5.3-μm spectrum of HCO. The spectra have been recorded at the National Research Council, Ottawa, with a spectrometer in which the molecules are generated within the laser cavity. The new spectra have better signal-to-noise ratios and many of the lines show saturation or Lamp dips. The latter feature has not only improved the precision of measurement but also helped to resolve individual features in the crowded regions. The laser tube was of the sealed-off type, permitting the use of different isotopic forms of carbon monoxide.

The resulting laser lines gave access to additional transitions in the ν_2 band of HCO. (9 refs.)

66033 The ^{13}C hyperfine splittings in ESR spectra of prop-2-ynyl and 1-(trimethylsiloxy)prop-2-ynyl radicals. J.C.Walton (Dept. of Chem., Univ. of St. Andrews, Fife, Scotland).
J. Magn. Resonance (USA), vol.52, no.2, p.241-6 (April 1983).
The ^{13}C satellite lines were observed in the 9.4 GHz ESR spectra of prop-2-ynyl and 1-trimethylsiloxyprop-2-ynyl radicals generated from precursors containing ^{13}C in natural abundance. The ^{13}C HFS indicate that prop-2-ynyl radicals adopt the π-delocalized structure, not the σ-allenyl form. The HFS of 1-trimethylsiloxyprop-2-ynyl radicals indicate that there is appreciable delocalization of spin onto the trimethylsiloxy group and that the radical is essentially planar at C(1). A linear correlation of a(C) with a(H) is shown to hold for a number of neutral hydrocarbon π-delocalized radicals. The experimental HFS are compared with spin densities calculated by a variety of semiempirical and ab initio SCF MO methods. (24 refs.)

66034 Study of the radical-cations of triethylamine and benzene derivatives by the optical detection of the EPR spectra of radical-ion pairs. V.M.Grigoryants, O.A.Anisimov, Yu.N.Molin (Inst. of Chemical Kinetics & Combustion, Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.327-33 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.4-10 (May-June 1982). [received: Feb. 1983]
The ODEPR method has been used to obtain the spectra of the radical-cations of hexamethylbenzene, durene, para-xylene, in triethylamine and non-polar liquid solutions at different temperatures, including temperatures close to room temperature. The values of the HFS constants of the radical-cations whose spectra have been recorded for the first time (para-xylene and triethylamine) have been found to be close to the theoretically calculated values. (21 refs.)

66035 Complexes of a stable nitroxyl radical with hydroxyl-containing molecules in frozen solutions. S.A.Dikanov, A.V.Astashkin, Yu.D.Tsvetkov (Inst. of Chemical Kinetics & Combustion, Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.333-45 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.11-25 (May-June 1982). [received: Feb. 1983]
An analysis of modulation effects in the electron spin echo has shown that the nitroxyl 2,2,6,6-tetramethylpiperidine-1-oxyl radical forms complexes with hydroxyl-containing molecules in frozen vitreous solutions. A method has been developed for separating the contribution to the modulation from the nuclei of the molecules of the complex. Numerical calculations have been carried out to determine the parameters of the complexes which can describe the observed modulation effects. (13 refs.)

66036 Rotational correlation times and radii of dithiazol-2-yl and dithiazolidin-2-yl free radicals. S.A.Fairhurst, R.S.Pilkington, L.H.Sutcliffe (Donnan Chem. Lab., Univ. of Liverpool, Liverpool, England).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, no.2, p.439-52 (Feb. 1983).
1,3,2-dithiazol-2-yl and 1,3,2-dithiazolidin-2-yl radicals have been shown to be useful model compounds for detailed ESR studies of rotational reorientation in liquid and frozen media. Consequently they are also potentially useful spin probes and spin labels. The ESR powder spectra have been analyzed and the resulting g and A tensors were used to calculate rotational diffusion correlation times, rotational energetics of activation and effective radii. The latter are a closer match to radii calculated from geometric radii than has been found for model nitroxy radicals: the energetics of activation for rotational diffusion indicate that the non-polar character of the radicals minimises solute-solvent interactions. (28 refs.)

66037 Analysis of the ESR hyperfine coupling in mono- and bicyclic azine radical anions by means of calculated spin densities. M.H.Palmer, I.Simpson (Dept. of Chem., Univ. of Edinburgh, Edinburgh, Scotland).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.415-27 (April 1983).
Ab initio studies of the spin density in mono- and bicyclic N hetero-aromatic compounds and naphthalene are reported. The wave functions were constructed from both minimal and double zeta bases in all cases, and both RHF and UHF formalisms were used together with quartet annihilation. The statistical variations in correlations between spin population density and hyperfine coupling are investigated. After annihilation the MB and DZ wave functions become relatively similar, but do lead to some differences in assignment for the smaller values of a_H. In general the agreement between a_H/a_N and calculated density is improved by two term rather than one term expressions, but there are still a number of experimental hyperfine couplings awaited. (77 refs.)

66038 ESR of cation radicals of methyl-substituted benzenes in a CF_3CCl_3 matrix. M.Tabata, A.Lund (Studsvik Sci. Res. Lab., Nykoping, Sweden).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.428-33 (April 1983).
A new matrix, 1,1,1-trifluorotrichloroethane, CF_3CCl_3, has been employed in radiation chemistry studies to stabilise positive ions. As a test, positive ions of benzene, toluene, ortho-, meta-and paraxylene and biphenyl have been generated by γ-irradiation of the solutes contained in the CF_3CCl_3 matrix at 77K. The ions have been investigated by ESR, and hyperfine couplings have been obtained. The data complement and correct the splitting values obtained previously in the adsorbed state. (33 refs.)

Ab initio SCF CI study of the electronic structure and spectrum of CuF_2 ....See Entry 65888

The lowest ^3E_u state of a metalloporphine in a crystal field of low symmetry. Directions of the stationary fields for electron spin resonance and phosphorescence Zeeman experiments ....See Entry 66040

Modulation spectrum from an electron-spin-resonance line ......See Entry 67992

33.35 DOUBLE RESONANCES AND OTHER MULTIPLE RESONANCES

Polarisation properties of irradiated ammonia (NH_3 and ND_3) at 1K and 25 kG ....See Entry 65757

Dynamic nuclear polarization of irradiated targets ....See Entry 65758

Two-photon absorption study of Zn(II)tetraphenylporphin: role of a higher excited singlet state of gerade symmetry ....See Entry 66005

33.35H MODR and PMDR (microwave optical double resonance and phosphorescence microwave double resonance)

66039 Infrared-microwave double-resonance probing of the population-depopulation of rotational states in the NO_2 molecule. B.Khoobehi, J.A.Roberts (Dept. of Phys., North Texas State Univ., Denton, TX, USA).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.227-33 (Feb. 1983).
A 10.6-μm CO_2 laser operating over a power range $5 \leq p \leq 135$ watts was used to pump some select vibrational transitions in the NO_2 molecule while monitoring the rotational transitions $(9_{1,9} \rightarrow 10_{0,10})$, $(23_{2,22} \rightarrow 24_{2,23})$, and $(40_{2,38} \rightarrow 39_{3,37})$ in the (0, 0, 0) vibrational level and the $(8_{0,8} \rightarrow 7_{1,7})$ rotational transition in the (0, 1, 0) vibrational level. These rotational transitions were monitored by microwave probing to determine how the population of states in the rotational manifolds was being altered by the laser. Coincidences between some components of the ν_3-ν_2 band of NO_2 and the CO_2 infrared laser lines in the 10-μm region appeared to be responsible for the strong interaction between the continuous laser beams and the molecular states. Characteristic rate curves for population-depopulation changes in the chosen rotational levels listed above were found for various power levels from the laser pump. Rate coefficients for intensity decay for various laser powers were calculated from experimental data and are presented. (11 refs.)

The phosphorescent state of γ-thiopyrones: optically-resolved zero-field splittings ....See Entry 66045

The identification of the $b^3\Pi$ state of copper monofluoride .....See Entry 66058

33.40 MÖSSBAUER SPECTRA

The application of ^{57}Fe Mossbauer spectroscopy to the characterization of nuclear waste forms ....See Entry 65364

A program to analyze series of Mossbauer spectra ....See Entry 68087

33.45 MAGNETO-OPTICAL AND ELECTRO-OPTICAL SPECTRA; DICHROISM

Infrared linear dichroism of the T_1 state of acridine in stretched polyethylene ....See Entry 65971

The absorption and circular dichroism bandshapes of chromophore aggregates as studied by a modified Green's function theory ....See Entry 66068

Linear dichroism studies of flavins in stretched poly(vinyl alcohol) films. Molecular orientation and electronic transition moment directions ..See Entry 66069

33.45B Zeeman and Stark effects

66040 The lowest ^3E_u state of a metalloporphine in a crystal field of low symmetry. Directions of the stationary fields for electron spin resonance and phosphorescence Zeeman experiments. W.A.J.A.van der Poel, A.M.Nuijs, M.Noort, J.H.van der Waals (Center for the Study of the Excited States of Molecules, Huygens Lab., Univ. of Leiden, Leiden, Netherlands).
J. Phys. Chem. (USA), vol.86, no.26, p.5191-7 (23 Dec. 1982).
When a metalloporphine is excited to its lowest ^3E_u state in a crystalline environment of low symmetry the orbital degeneracy is removed. Expressions are derived for (1) the in-plane stationary directions for the ESR transitions between the three spin components of the lower orbital state in a magnetic field and (2) the in-plane stationary directions of the relative intensity I_O/I_1, of the two Zeeman components in the phosphorescence with $\Delta m=0,1$. The two pairs of axes do not coincide, unless the simple Jahn-Teller plus crystal field model holds in which the molecule in its phosphorescent state retains two of its ground-state in-plane twofold axes. (22 refs.)

Infrared diode laser spectroscopy of the FO radical ($^2\Pi_{3/2}$) .....See Entry 65981

Variation of dipole moments with triplet state energy spacings in substituted benzaldehydes ....See Entry 66047

33.50 FLUORESCENCE, PHOSPHORESCENCE; RADIATIONLESS TRANSITIONS (INTERSYSTEM CROSSING, INTERNAL CONVERSION)

66041 Shift of emission band upon excitation at the long-wavelength absorption edge. Time-dependent fluorescence shift of a fluid ethanol solution of 6-methoxyquinoline. T.Ikeyama, T.Azumi (Dept. of Chem., Faculty of Sci., Tohoku Univ., Sendai, Japan), T.Murao, I.Yamazaki.
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.419-21 (15 April 1983).
The fluorescence spectrum of 6-methoxyquinoline in fluid ethanol solution at 294K shifts progressively to the red with time. The results are discussed in connection with the excitation-energy-dependent fluorescence shift previously studied. (13 refs.)

66042 Two-photon laser-induced fluorescence studies of HS radicals, DS radicals, and I atoms. J.J.Tiee, M.J.Ferris, G.W.Loge, F.B.Wampler (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.422-5 (15 April 1983).
A two-photon laser-induced excitation and fluorescence technique has been used to study the $A^2\Sigma^+$-$X^2\Pi$ transition of HS and DS radicals and various high-lying $^4P^0$, $^2D^0$, and $^4D^0$ states of the I atom. The two-photon excitation cross sections and detection sensitivity are discussed. (13 refs.)

66043 Photochemistry of benzophenone in micelles. Phosphorescence emission from aromatic ketones in micellar solution. W.J.Leigh, J.C.Scaiano (Div. of Chem., Nat. Res. Council, Ottawa, Ontario, Canada).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.429-32 (15 April 1983).
Benzophenone phosphoresces in sodium dodecyl sulfate and other micelles at room temperature and the spectrum approaches that observed in hydrocarbon solution and/or glasses at 77K. (22 refs.)

66044 Picosecond fluorescence decay kinetics of crystal violet in low-viscosity solvents. T.Doust (Davy Faraday Res. Lab., Royal Inst., London, England).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.522-5 (22 April 1983).
Picosecond fluorescence techniques have been used to study the viscosity-dependent non-radiative decay rates of crystal violet in low-viscosity solvents. Dual-exponential behaviour is observed in all cases with anomalous behaviour in diols. The data are interpreted in terms of recent models of radiationless decay mediated by conformational relaxation. (12 refs.)

66045 **The phosphorescent state of γ-thiopyrones: optically-resolved zero-field splittings.** M.R.Taherian, A.H.Maki (Dept. of Chem., Univ. of California, Davis, CA, USA).

Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.541-6 (22 April 1983).

The phosphorescence spectra, ODMR, and triplet sublevel kinetics are reported for the thioketones, 4H-pyran-4-thione (PT) and 2,6-dimethyl-4H-pyran-4-thione (DMPT). Extremely large ZFS parameters, $D=-24$, and $-28\ \mathrm{cm}^{-1}$, are assigned to two distinct trap sites of PT in *n*-pentane and $D=-24\ \mathrm{cm}^{-1}$ for the major site of DMPT in *n*-hexane. (19 refs.)

66046 **A compact synchroscan streak camera using a microchannel plate incorporated tube.** M.Yamashita (Laser Res. Section, Electrotech. Lab., Ibaraki-ken, Japan), T.Honda, T.Sato, K.Aizawa.

IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.124-6 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).

A compact synchroscan streak camera, which incorporates microchannel plates providing a high light gain, has been constructed. The camera has been operated in synchronism with a synchronous-passive hybrid mode-locked CW dye laser, and the overall time resolution has been 10.8 and 25.9 ps for a recording of ~ 160 and $\sim 10^8$ cycles of dye laser pulses, respectively. By using the camera system with the dye laser a weak fluorescence profile (a quantum yield of $\sim 10^{-3}$) of an important biomolecule has been directly observed on a picosecond time scale. (10 refs.)

66047 **Variation of dipole moments with triplet state energy spacings in substituted benzaldehydes.** I.C.Winkler, D.M.Hanson (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).

J. Chem. Phys. (USA), vol.78, no.8, p.4836-9 (15 April 1983).

Recent studies of the Stark effect on bands in the laser induced phosphorescence excitation spectrum of 2,4,5-trimethylbenzaldehyde, isolated in a durene single crystal, revealed that the dipole moment associated with the most intense feature in the spectrum, believed to arise from the $T_2(n\pi^*)$ state, was the same within experimental uncertainty as that for the $T_1(\pi\pi^*)$ origin. This result may indicate that the $T_2(n\pi^*)$ state is strongly coupled to a set of nearby $T_1(\pi\pi^*)$ vibronic levels. In order to evaluate the effect of the density of $\pi\pi^*$ vibronic levels on the dipole moment of the $T_2(n\pi^*)$ state, the authors have made similar measurements on 2,4- and on 2,5-dimethylbenzaldehyde. They have found that as the T_1-T_2 energy spacing decreases, the dipole moment of the second triplet state becomes more characteristic of an $n\pi^*$ state. (12 refs.)

66048 **Photophysical properties of benzimidazole and thiabendazole and their homologues. Effect of substituents and solvent on the nature of the transition.** P.C.Tway, L.J.Cline Love (Dept. of Chem., Seton Hall Univ., South Orange, NJ, USA).

J. Phys. Chem. (USA), vol.86, no.26, p.5223-6 (23 Dec. 1982).

The photophysical characteristics of benzimidazole and thiabendazole, and ten of their derivatives, are evaluated to determine the nature of the transitions occurring and how the excited states interact with the species microenvironment. On the basis of the fluorescence and phosphorescence energies, quantum yields, and lifetimes, these benzimidazole homologues appear to be excited to a manifold of single states. Which excited state predominates, either $\pi \leftarrow \pi^*$ or charge transfer, depends on the side-chain substituent, solvent system, pH, and temperature. (22 refs.)

66049 **Temperature dependence of the fluorescence lifetime of benzene in cryogenic solutions.** F.Li, J.Lee, E.R.Bernstein (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA).

J. Phys. Chem. (USA), vol.87, no.2, p.254-60 (20 Jan. 1983).

Fluorescence lifetimes for C_6D_6 in various hydrocarbon solvents have been measured as a function of concentration and temperature. For the solvents ethylene, ethane, and propane it is found that at low concentrations (~ 0.3 ppm or $\sim 4\times 10^{-6}$ mol/L) the fluorescence lifetime is roughly temperature independent ($90 \leq T \leq 220$K) and equal to the gas-phase value of ~ 150 ns. As the concentration is increased ($1 \leq c \leq 100$ ppm), the lifetime decreases as temperature is increased, reaching a minimum value at about 150K of roughly 70-100 ns, depending on the concentration. As the temperature is increased from 150 to 220K, the lifetime increases to well over 100 ns. (16 refs.)

66050 **Spectroscopic studies of pyrazine in cryogenic solutions.** J.Lee, F.Li, E.R.Bernstein (Dept. of Chem., Colorado State Univ., Fort Collins, CO, USA).

J. Phys. Chem. (USA), vol.87, no.2, p.260-5 (20 Jan. 1983).

The first excited singlet ($^1B_{3u}$) and triplet ($^3B_{3u}$) states of pyrazine are studied in the cryogenic liquids CH_4, C_2H_6, C_3H_8, C_4G_{10}, C_2H_4, C_3H_6, and 1-C_4H_8. The reported data include $^1B_{3u} \rightleftharpoons {}^1A_{1g}$ absorption, fluorescence, and lifetimes and $^3B_{3u} \rightarrow {}^1A_{1g}$ phosphorescence and lifetimes as a function of temperature and concentration. From the behavior of the $^1B_{3u} \rightleftharpoons {}^1A_{1g}$ system it is concluded that hydrogen bonding is an important feature of the intermolecular potential in these solutions. (17 refs.)

66051 **Lowest excited singlet state of hydrogen-bonded methyl salicylate.** L.A.Helmbrook, J.E.Kenny, B.E.Kohler, G.W.Scott (Dept. of Chem., Wesleyan Univ., Middletown, CT, USA).

J. Phys. Chem. (USA), vol.87, no.2, p.280-9 (20 Jan. 1983).

The dual fluorescence shown by methyl salicylate in solution and the room temperature vapor phase has been observed for methyl salicylate seeded in a supersonic helium jet. Under these conditions low rotational and vibrational temperatures are attained, making it possible to measure highly resolved excitation spectra for each of the emission components. The measurement of these excitation spectra is reported together with emission spectra and emission decay kinetics as a function of excitation wavelength for both methyl salicylate-*h* and methyl salicylate-*d* in a supersonic jet. The measured spectra are analyzed to determine the nature of the excited states responsible for the dual emission. (37 refs.)

66052 **Quantum beats in the fluorescence of jet-cooled SO_2 ($\tilde{A}^1A_2$) under a weak magnetic field.** H.Watanabe, S.Tsuchiya (Dept. of Pure & Appl. Sci., Univ. of Tokyo, Meguro-ku, Tokyo, Japan), S.Koda.

J. Phys. Chem. (USA), vol.87, no.6, p.906-8 (17 March 1983).

The fluorescence from $SO_2(\tilde{A}^1A_2)$ in a single ro-vibronic level, which is formed through the $^rR_0(0)$ transition of the 'E' band absorption of jet-cooled SO_2, shows a beating decay under an applied weak magnetic field. The polarization of the beating fluorescence and its frequency as a function of the magnetic field strength can be analyzed on the basis of the theory of time-dependent level crossing spectroscopy. It was shown that this particular rotational level of the upper electronic state ($^1A_2$) possesses an anomalously high magnetic moment ($g_J=0.14$) through intramolecular couplings among the relevant electronic states. (13 refs.)

66053 **Effects of molecular rotation on electronic relaxation processes in pyrazine and pyrimidine with particular regard to pressure dependence.** H.Baba, N.Ohta, O.Sekiguchi, M.Fujita, K.Uchida (Div. of Chem., Hokkaido Univ., Sapporo, Japan).

J. Phys. Chem. (USA), vol.87, no.6, p.943-52 (17 March 1983).

Fluorescence quantum yields and decays have been measured along the rotational contour of the O-O band in the $S_1 \leftarrow S_0$ absorption of pyrazine and pyrimidine in the vapor phase at different pressures. The results are discussed on the basis of a kinetic model and of a quantum-mechanical treatment of the intermediate case with emphasis on the role of rotational levels in S_1-T coupling and in collisional quenching of fluorescence. In each molecule, the fluorescence quantum yield spectrum at low pressure exhibits a sharp peak near the band origin. As the pressure increases, the peak becomes less pronounced, and the yield spectrum is rather flat at moderately high pressure, indicating that the marked rotational-level dependence of the quantum yield is attributable mainly to the slow component of fluorescence. It is shown that the rotational relaxation leads predominantly to quenching of the slow fluorescence. (31 refs.)

66054 **Application of the energy gap law to nonradiative, excited-state decay.** J.V.Caspar, T.J.Meyer (Dept. of Chem., Univ. of North Carolina, Chapel Hill, NC, USA).

J. Phys. Chem. (USA), vol.87, no.6, p.952-7 (17 March 1983).

As predicted by the energy gap law, which can be used to relate excited-state, nonradiative decay rate constants (k_{nr}) and emission energies (E_{em}), the authors show that plots of ln k_{nr} vs. E_{em} are linear for (1) the MLCT excited states in the series $Re(bpy)(CO)_3L^+$ (bpy is 2,2′-bipyridine; $L=PMe_3$, CH_3CN, ...); (2) the d-d excited states in the series $Rh(NH_3)_5L^{3+}$ ($L=CH_3CN$, py, ...); (3) solvent effects for π-π^* fluorescence from 6-hydroxy-9-phenylfluoron and fluorescein; (4) the dσ^*-σp excited states of the dimers $Rh_2(CNR)_4(AA)_2$ (AA=bis(diphenylphosphino)methane or bis(diphenylarsino)methane). (20 refs.)

66055 **Statistical limit of S_1 pyrimidine quenching.** G.Loge (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).

J. Phys. Chem. (USA), vol.87, no.6, p.969-72 (17 March 1983).

An approximate quantum theory previously used to explain biexponential decay of intermediate-case excited-state molecules is used to explain an experimentally observed nonlinear pressure dependence of collision-induced-state crossing in intermediate-case nonradiative transitions. The inverse of the fluorescence yield derived from this model is fitted to experimentally obtained quenching data for the lowest vibrational level of S_1 pyrimidine, which crosses to the T_1 state with nearly small-molecule behavior but with some biexponential behavior. O_2 and NO used as added gases showed somewhat different quenching behavior than the other added gases, reaching a higher statistical limit. (19 refs.)

66056 **Correspondence between rotational relaxation and collision-induced intersystem crossing in S_1 pyrimidine.** A.E.W.Knight (School of Sci., Griffith Univ., Brisbane, Queensland, Australia), J.T.Jones, C.S.Parmenter.

J. Phys. Chem. (USA), vol.87, no.6, p.973-83 (17 March 1983).

Measurements are presented of the absolute rate constants for collision-induced crossing (CIC) from S_1 to triplet pyrimidine vapor when either S_0 pyrimidine or added gases (He, Ne, CO, C_6H_{12}, trans-$C_2H_2Cl_2$, cis-$C_2H_2Cl_2$) serve as collision partners. Data are secured for crossing from each of four initial S_1 levels with $\varepsilon_{vib} \leq 1012\ \mathrm{cm}^{-1}$. The collisional efficiencies range from 0.8 to 7.5 for the 0^0level and are largely unchanged for each of the higher levels. The perturbed-state model of CIC by W.M. Gelbart and K.F. Freed (1973) is obtained in a form useful for explicit comparisons of data. The data correspond closely with the model in a version that links CIC with rotational but not vibrational relaxation within the triplet manifold. A new measurement establishes the zero-pressure S_1 fluorescence yield from the 0^0 level as 0.38. (45 refs.)

66057 **Laser-induced fluorescence and inelastic collisions of KH molecule.** A.Pardo, J.M.L.Poyato, M.S.Guijarro, J.I.Fernandez-Alonso (Dept. de Quimica Fisica y Quimica Cuantica, Univ. Autonoma de Madrid, Madrid, Spain).

J. Mol. Spectrosc. (USA), vol.97, no.2, p.248-52 (Feb. 1983).

The laser-induced fluorescence spectrum of KH vapor, excited by the 4881-Å argon ion laser line, was obtained and analyzed. The transition was found to involve the $A^1\Sigma^+$ and $X^1\Sigma^+$ states. Vibrational and rotational energy transfer is detected. The spectrum presents a clear differentiation of bandheads. The molecular constants obtained are in good agreement with the previously reported data. (11 refs.)

66058 **The identification of the $b^3\Pi$ state of copper monofluoride.** C.R.Brazier, J.M.Brown (Southampton Univ., Southampton, England), T.C.Steimle.

J. Mol. Spectrosc. (USA), vol.97, no.2, p.449-53 (Feb. 1983).

The authors recently reported on the yellow system of bands in the electronic spectrum of CuF, recorded at Doppler-limited resolution by laser-induced fluorescence. This work was prompted by an earlier study by Ahmed et al. (1982), who had found that the system consisted of two subbands, involving transitions from the ground $^1\Sigma^+$ state to excited levels with $\Omega=0^+$ and 1 about 55 cm^{-1} apart. It was possible to interpret the upper state either as a *p* complex, that is, a $^1\Sigma^+$ and $^1\Pi$ state lying close together or as a $^3\Sigma^-$ state with a large spin-spin splitting. The initial aim of the present work was to observe and measure nuclear hyperfine structure in the hope that such observations would favor one assignment over the other. In the event, the splittings due to the ^{63}Cu nucleus ($I=3/2$) were large enough to be observable even at Doppler-limited resolution in the $\Omega=0^+$ and 1^+ subbands for *J* values above about 20. However, the authors were able to fit the structure equally well to either of the proposed electronic models. Indeed, more careful investigation revealed that the exact equivalence between the spin and rotational levels of a *p* complex and of a $^3\Sigma^-$ state extended through to the hyperfine structure as well. Subsequently, the authors have obtained additional information on the hyperfine interactions with two sub-Doppler techniques, intermodulated fluorescence (IMF) and microwave optical double resonance (MODR). (10 refs.)

66059 **Highly resolved electronic spectra and electronic structure of benzo[f]quinoxaline.** K.Brenner, J.Lipinski, Z.Ruziewicz (Inst. of Organic & Phys. Chem., Tech. Univ., Wroclaw, Poland).

J. Lumin. (Netherlands), vol.28, no.1, p.13-26 (March-April 1983).

Vibrational analysis of highly resolved phosphorescence (P), fluorescence (F) and absorption spectra of bonzo[f]quinoxaline (BQ) in Shpolskii matrices, at 77K, was carried out. The spectra were dominated by phenanthrene-type fundamental vibrations. The appearance of several out-of-plane (op) modes in the P spectrum as well as the P lifetime, much shortened relative to that of the parent hydrocarbon, point to the proximity of the lowest n, π^* and π, π^* states of the BQ molecule. High activity of op modes in the F spectrum and complex structure of the absorption spectrum onset have been examined in terms of the pseudo-Jahn-Teller interaction between close-lying S_1 (π, π^*) and S_2(n, π^*) states. According to calculations of the BQ electronic structure, performed using a modified INDO CI method, the $T_1(\pi, \pi^*)$-$T_2(\mathrm{n}, \pi^*)$ and

$S_1(\pi, \pi^*)$-$S_2(n, \pi^*)$ energy gaps are about 1200 and 700 cm^{-1}, respectively. (34 refs.)

66060 Highly resolved electronic absorption and luminescence spectra of some phenanthrolines in Shpolskii matrices. II. Fluorescence and $S_1 \leftarrow S_0$ absorption spectra. H.Basara (Inst. of Organic & Phys. Chem., Tech. Univ., Wroclaw, Poland).
J. Lumin. (Netherlands), vol.28, no.1, p.73-86 (March-April 1983).
For pt.I see ibid., vol.17, p.283 (1978). Highly resolved fluorescence and $S_1 \leftarrow S_0$ absorption spectra of some phenanthrolines in *n*-alkane matrices were obtained at 77K. The vibrational analysis of the spectra was carried out. Mirror symmetry distortions of the fluorescence and absorption spectra were attributed to vibronic coupling between $^1(\pi, \pi^*)$ states. It was shown that vibronic mixing of $S_1(\pi, \pi^*)$ and $S_2(\pi, \pi^*)$ states occurs in phenanthroline molecules with S_1-S_2 energy gap not exceeding 3000 cm^{-1} (i.e. 4,7-, 1,7- and 1,10-Phen), whereas in other phenanthrolines the coupling of S_1 and $S_3(\pi, \pi^*)$ plays a dominant role. Fluorescence quantum yields of phenanthroline liquid solutions were measured. Changes of luminescence efficiencies due to the change of the polarity of the media point to a weak coupling of the lowest $^1(\pi, \pi^*)$ and $^1(n, \pi^*)$ states. (23 refs.)

66061 Fluorescence excitation spectra of jet-cooled amino-phthalimides. M.Asimov, N.P.Ernsting (Max-Planck-Inst. fur Biophys. Chem., Gottingen, Germany).
J. Lumin. (Netherlands), vol.28, no.1, p.119-21 (March-April 1983).
Reports the fluorescence excitation spectra of the $\pi\pi^*$ transition of jet-cooled 3-amino-, 3-amino-N-methyl-, and 4-amino-N-methyl-phthalimide. The spectra are dominated by a long progression of a vibrational mode $\nu' \approx 210$ cm^{-1} in combination with a few vibrational fundamentals of the excited state. The long electronic lifetimes and structural diversity of these compounds make them ideally suited for the study of intramolecular vibronic relaxation. (6 refs.)

66062 Possibility of the investigation of conformational changes in protein molecules with fluorescent probes in the picosecond time range. V.P.Mikhailov, M.I.Demchuk, K.V.Yumashev.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.777-80 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.60-4 (July 1982). [received: March 1983]
From an investigation of transport proteins in human blood the authors conclude that the method of fluorescent probes in the picosecond time range can be used successfully both for studying the structural states of protein molecules and for studying the dynamics of the behavior of water-protein systems. (7 refs.)

66063 Spectral-kinetic properties of the delayed fluorescence of complex molecules with inhomogeneously broadened energy levels. S.K.Gorbatsevich, I.M.Gulis, A.I.Komyak, Yu.I.Miksyuk.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.804-8 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.92-7 (July 1982). [received: March 1983]
A study is presented of the manifestation of inhomogeneous broadening of the levels in the spectral and kinetic characteristics of delayed emission from complex molecules, i.e. processes which involve the triplet states. The systems studied were solid films of polyvinyl alcohol containing acridine dyes which exhibit both phosphorescence as well as delayed fluorescence (at room temperature). (18 refs.)

66064 Dependence of selectively excited fine-structure fluorescence spectra of organic molecules on the wavelength of the exciting light. K.N.Solovev, I.V.Stanishevskii, A.S.Starukhin, A.M.Shulga.
Opt. & Spectrosc. (USA), vol.53, no.3, p.230-1 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.389-92 (Sept. 1982). [received: May 1983]
Investigates fine-structure spectra at 4.2K with selective laser excitation for four metalloporphyrins, which by virtue of asymmetry due either to side substituents or attachment of extraligands, have had their twofold degeneracy of the lowest singlet excited level removed, of which polarization measurements provide evidence. The interval S_1-S_2 of the chosen objects of investigation acquired values from 80 to 400 cm^{-1}. It appears to the authors that the basic cause of the nonidentical nature of the intervals S_0-S_1 for the types of center selectively excited in the $S_0 \rightarrow S_2$ path is the difference in orientation of the moments of $S_0 \rightarrow S_1$ electronic transitions of impurity centers having identical intervals S_0-S_2 in relation to the solvent molecules. (5 refs.)

66065 Nuclear-motion randomization and hot-luminescence spectra of complex molecules. V.L.Bogdanov, V.P.Klochkov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.233-4 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.394-6 (Sept. 1982). [received: May 1983]
Reports the results of a study using the hot luminescence (HL) method. The authors have investigated the intramolecular redistribution of vibrational energy Q in complex molecules and the dependence of this phenomenon on the temperature and the solvent. The HL of the perylene molecule for which a value of Q was given has been studied. The concentration of the solutions was $\sim 10^{-5}$ M. HL is observed in the anti-Stokes region of the spectrum when the ν_2 photon is absorbed. The shape of the spectrum essentially depends on the state of the solvent and the temperature. It follows from the data obtained that the rate of establishment of the intramolecular equilibrium distribution in the region of randomization depends on the properties and state of the medium. It increases on transition from a Shpolskii matrix to solid alcohol and to liquids at room temperature. Excitation of all modes for the systems investigated proceeds at rates that are significantly faster than the rates of establishment of an equilibrium distribution. (8 refs.)

Two-photon absorption study of Zn(II)tetraphenylporphin: role of a higher excited singlet state of gerade symmetry ....See Entry 66005

The lowest ^3E_u state of a metalloporphine in a crystal field of low symmetry. Directions of the stationary fields for electron spin resonance and phosphorescence Zeeman experiments ....See Entry 66040

Photodissociation of partially solvated molecules in beams by the picosecond-jet technique: hydrogen bond breakage .... See Entry 66078

The $\tilde{A}^1A_1$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,2-difluorobenzene ....See Entry 66085

Pulsed molecular beam study of state-to-state vibrational excitation in $He+I_2$ collisions: energy dependence of the $v=0 \rightarrow 1$ cross section ......See Entry 66102

Solvent motion controls the rate of intramolecular electron transfer in solution
....See Entry 66121

Theoretical and experimental investigation of electronically excited states, luminescence properties, and lasing capability of pyrene and its phenylethynyl derivatives ....See Entry 66266

Dynamics of fluorescence quenching in micellar systems [and reply] ....
....See Entry 68294

Photochemistry in Van der Waals complexes: observation of the intermediate state of the Hg^*, Cl_2 reaction .... See Entry 68783

Comparative studies between monomeric and polymeric sodium 10-undecenoate micelles ....See Entry 68807

33.65 PHOTOELECTRON SPECTRA

66066 The electron angular distribution of different rotational branches in the VUV photoelectron spectrum of H_2. M.-W.Ruf, T.Bregel, H.Hotop (Fachbereich Phys. Univ. Kaiserslautern, Kaiserslautern, Germany).
J. Phys. B (GB), vol.16, no.9, p.1549-64 (14 May 1983).
By high-resolution photoelectron spectrometry using a cooled $H_2(\nu''=0, J''=0,1)$ target beam, the authors have determined the relative intensities of the Q and S rotational branches for several $H_2^+(\nu')$ vibrational states at photon wavelengths of 58.4, 73.6 and 74.4 nm. From results measured at different angles between the direction of the unpolarised photon beam and the momentum of the ejected electrons, they have determined the angular anisotropy parameter β_s for S-branch electrons ($\Delta J=2$ transitions), and find (e.g. for $\nu'=0$) $\beta_s(58.4 \text{ nm})=0.81(17)$, $\beta_s(73.6 \text{ nm})=0.54(16)$ and $\beta_s(74.4 \text{ nm})=0.76(27)$. These data show that at photoelectron energies of 5 eV and 1 eV the contribution due to f-electron waves cannot be ignored. A search for $\Delta J=4$ transitions at 58.4 nm has yielded an upper limit of 0.3% with respect to the $\Delta J=0$ partial cross section. (34 refs.)

66067 Shape resonance phenomena in CO following *K*-shell photoexcitation. C.M.Truesdale, S.H.Southworth, P.H.Kobrin, U.Becker, D.W.Lindle, HG.Kerkhoff, D.A.Shirley (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1265-8 (25 April 1983).
Electron cross sections and asymmetries following photoexcitation of the CO *K* shells were measured directly. Energy analysis of ejected electrons yielded cross sections exhibiting σ shape resonances in the $C(1s)$, $C(KVV)$, and $O(1s)$ channels, and a π resonance in the $C(KVV)$ channel, confirming earlier indirect measurements. Asymmetry measurements showed a σ shape resonance in the $C(1s)$ channel, in good agreement with the predictions of Dehmer and Dill (1977). The $C(KVV)$ π resonance showed nearly isotropic behavior. (16 refs.)

Recent developments in photoelectron dynamics using synchrotron radiation .....
....See Entry 65931

33.70 INTENSITIES AND SHAPES OF MOLECULAR SPECTRAL LINES AND BANDS

66068 The absorption and circular dichroism bandshapes of chromophore aggregates as studied by a modified Green's function theory. M.Kamiya (Lab. of Phys. Chem., Shizuoka Coll. of Pharmacy, Shizuoka-shi, Japan).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.569-74 (22 April 1983).
A modified Green's function method is applied to calculating the aggregate bandshape whereby a decoupling approximation for vibrationally averaging the Green's function is used to include thermal and static effects as well in terms of the correction shift of the chromophore bandshape. The utility of the method is shown by a sample calculation of the absorption and circular dichroism bandshapes of a model dimer. (12 refs.)

66069 Linear dichroism studies of flavins in stretched poly(vinyl alcohol) films. Molecular orientation and electronic transition moment directions. Y.Matsuoka, B.Norden (Inst. of Phys. Chem., Chalmers Univ. of Technol., Gothenburg, Sweden).
J. Phys. Chem. (USA), vol.87, no.2, p.220-5 (20 Jan. 1983).
Linear dichroism of 3-methyllumiflavin (MLF) and riboflavin (RF) partially oriented in stretched poly(vinyl alcohol) (PVA) film was measured in the 220-530-nm region to determine the directions of the electronic transition moments. IR dichroism was measured in the same stretched films in the region 1900-1500 cm^{-1} to obtain information about the molecular orientation tensor. The four important π-π^* transitions of 3-methyllumiflavin, with absorption at 448, 360, 270, and 225 nm in poly(vinyl alcohol) medium, were found to be polarized at the angles (counterclockwise direction) 50°, 74°, 90°, and 40° with respect to the N_5-N_{10} line. The corresponding transitions of riboflavin, occurring at 448, 365, 270, and 25 nm, were found at the angles 45°, 68°, 76°, and 39°, respectively. (32 refs.)

66070 Lifetime of electronic states of CO_2^+. C.Herran, F.Arqueros, J.Campos (Catedra de Fisica Atomica Experimental, Univ. Complutense, Madrid, Spain).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.244-7 (Feb. 1983).
The radiative lifetimes of the $\tilde{A}^2\Pi_u$ and $\tilde{B}^2\Sigma_u^+$ states of CO_2^+ were measured by means of the delayed coincidence method. Excitation was performed by a pulsed electron beam incident on CO_2. The results of these measurements are 115±5 nsec for the $\tilde{A}^2\Pi_u$ state and 126±3 nsec for the $\tilde{B}^2\Sigma_u^+$ state. (17 refs.)

66071 Direct retrieval of lineshape parameters: absolute line intensities for the ν_2 band of CH_3D. C.Chackerian,Jr., G.Guelachvili (Lab. d'Infrarouge, Univ. de Paris-Sud, Orsay, France).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.316-32 (Feb. 1983).
A nonlinear least-squares technique is applied to the ν_2 band of CH_3D to obtain lineshape parameters (intensity, position, and broadening). Some self-shift parameters are also reported. For the ν_2 band of $^{12}CH_3D$, line intensities with $J'' \leq 15$ and $K'' \leq 7$ are well represented with a squared vibrational transition dipole matrix element and 'Herman-Wallis' factor equal respectively to $(8.798 \pm 0.014) \times 10^{-4}$ $(\text{debye})^2$ and $F(m)=1+(0.0135 \pm 0.0004)$ m. Intensity parameters are also reported for the ν_2 band of $^{13}CH_3D$. Rough estimates are given for 'Herman-Wallis' factors for the *P* branches of the $2\nu_6$ transition of $^{12}CH_3D$. (24 refs.)

66072 Strengths and Lorentz broadening coefficients for spectral lines in the ν_3 and $\nu_2+\nu_4$ bands of $^{12}CH_4$ and $^{13}CH_4$. V.M.Devi, B.Fridovich, G.D.Jones, D.G.S.Snyder (Nat. Earth Satellite Service, NOAA, Washington, DC, USA).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.333-42 (Feb. 1983).
Line strengths and self- and nitrogen-broadened half-widths were measured for spectral lines in the ν_3 and $\nu_2+\nu_4$ bands of $^{12}CH_4$ and $^{13}CH_4$ from 2870-2883 cm^{-1} using a tunable diode laser spectrometer. From measurements made over a temperature range from 215 to 297K, on samples of $^{12}CH_4$ broadened with N_2, the authors deduced that the average temperature coefficients *n*, defined as $b_L^0(T)=b_L^0(T_0)(T/T_0)^{-n}$, of the Lorentz broadening coefficients for the ν_3 and $\nu_2+\nu_4$ bands of $^{12}CH_4$ were 0.97±0.03 and 0.89±0.04, respectively. A smaller increase is observed in line half-width with increasing pressure for *E*-species lines, for both self- and nitrogen-broadening, than for other symmetry species lines over the range of pressures measured, 70 to 100 Torr. (22 refs.)

66073 Collisional broadening of nitrous oxide transition lines in the $\nu_1+2\nu_2$ band by noble gases. A.H.M.Sondag, H.A.van der Liet, G.H.Wegdam (Lab. for Phys. Chem., Univ. of Amsterdam, Amsterdam, Netherlands).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.353-61 (Feb. 1983).
A tunable diode laser is used to measure the foreign gas broadening for several rotational states in the *R* branch of the 12^00-00^00 vibration-rotation band of N_2O. The results indicate that rotational relaxation is the chief pressure broadening mechanism. The resulting cross sections for He and Ne turn out to be almost independent of the rotational quantum number. Ar and Kr, however, show a clear dependency. This seems to contradict the results of the infinite order sudden approximation. (22 refs.)

66074 Theory of impact broadening of the rotational ammonia spectrum. A.I.Petrova, M.R.Cherkasov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.252-6 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.429-34 (Sept. 1982). [received: May 1983]
It is noted that collisional relaxation gives rise to interference between the components of the rotational doublets of the ammonia molecule, which leads to their correlated broadening. The corresponding model is introduced, and computational expressions for the entire set of collisional relaxation parameters are obtained. Specific computations are made for the case of self-broadening. A comparison of the computed values of halfwidths with experimental data is given. (16 refs.)

66075 Algorithm for evaluating Franck-Condon integrals. M.D.Elkin.
Opt. & Spectrosc. (USA), vol.53, no.3, p.335-6 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.566-7 (Sept. 1982). [received: May 1983]
Analysis of molecular electronic-vibrational spectra requires the development of reliable and effective computer methods for evaluating the overlap integrals of the vibrational wave functions. The authors describe an algorithm for evaluating Franck-Condon integrals, which is general and simple in computer implementation. (3 refs.)

66076 $B^1\Pi$-$X^1\Sigma$ and $C^1\Sigma$-$X^1\Sigma$ electron-transition strengths of the SrO molecule. I.A.Svyatkin, L.A.Kuznetsova, YuYa.Kuzyakov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.339-40 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.572-5 (Sept. 1982). [received: May 1983]
Reports a continuation of a study of the electron-transition strengths of molecules of alkaline earth oxides. On the spectrograms the authors observed bands corresponding to the transitions $B^1\Pi$-$X^1\Sigma$ and $C^1\Sigma$-$X^1\Sigma$ of the SrO molecule (λ=300-400 nm) and also two intense groups of bands in the yellow and red regions, which have tentatively been attributed to several singlet and triplet transitions of SrO and two transitions of SrOH. A quantitative analysis could be carried out only in the spectra of the *B*-*X* and *C*-*X* systems. Since these spectra lie in a wavelength region that overlaps the Schumann-Runge system ($B^3\Sigma_u^-$-$X^3\Sigma_g^-$) of oxygen, the authors used mixtures with a little oxygen as possible (O_2:Ar=1:5, 1:9) in an effort to suppress the effect of this oxygen system as much as possible. The calculated intensity of the oxygen absorption lines did not exceed 5-8% of the total intensity for any of the regions studied. (13 refs.)

Time resolved high resolution spectroscopy using the high frequency deflection technique and supersonic jet targets. I. Instrumental; simplification of spectra; reductions of collisional quenching .... See Entry 64961

Equilibrium geometry and dynamics of the valence excited states of 1,3-butadiene .... See Entry 65897

Rydberg states with a $^2\Pi$ core: the $b^3\Pi_i$ and $C^2\Pi$ states of DCl .... See Entry 65901

A dielectric model for the solvent effect on the intensity of light absorption .... See Entry 65908

The translational-rotational absorption spectrum of hydrogen . See Entry 65969

High-resolution Fourier spectrometry of $^{14}N_2$ infrared emission spectrum: extensive analysis of the $B^3\Pi_g$-$A^3\Sigma_u^+$ system .... See Entry 65978

FTIR spectroscopic studies of the matrix photoionization and photolysis products of methylene halides .... See Entry 65980

Thermal molecular beam matrix spectroscopy of cyclobutanol: temperature dependence of lineshapes and the conformation problem .... See Entry 65998

Raman and IR studies of the antileprotic drug Dapsone .... See Entry 65999

Spectra of the ammonium radical: the Schuster band of ND_4 . See Entry 66003

Further measurement and analysis of lines in the LMR spectrum of HCO at 5.3 μm .... See Entry 66032

Shift of emission band upon excitation at the long-wavelength absorption edge. Time-dependent fluorescence shift of a fluid ethanol solution of 6-methoxyquinoline .... See Entry 66041

Temperature dependence of the fluorescence lifetime of benzene in cryogenic solutions .... See Entry 66049

Application of the energy gap law to nonradiative, excited-state decay .... See Entry 66054

Dynamics of photodissociation of HONO at 369 nm: motional anisotropy and internal state distribution of the OH fragment .... See Entry 66080

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{14}NH_3$ .... See Entry 66083

Constant of the second 0_g^+ ion-pair state of I_2 .... See Entry 66093

Fast beam radiofrequency spectroscopy .... See Entry 66149

On the lifetime of ortho-positronium (O-Ps) in molecular substances .... See Entry 66163

Line shape of anti-Stokes stimulated Raman scattering in organic dye solutions .... See Entry 66334

33.80 PHOTON INTERACTIONS WITH MOLECULES

66077 Manifestations of the optical activity of molecules in the dipole photoeffect. N.A.Cherepkov (A.F. Ioffe Phys.-Tech. Inst., Leningrad, USSR).
J. Phys. B (GB), vol.16, no.9, p.1543-8 (14 May 1983).
The lack of a plane of symmetry in the structure of optically active molecules leads, even in the dipole approximation, to the appearance of five new terms in the angular distribution of photoelectrons with defined spin orientation ejected from unoriented molecules by circularly polarised light. The vector structure of these terms is presented, and the possibility of their detection is discussed. Photoionisation of oriented chiral molecules is also discussed briefly. (15 refs.)

A dielectric model for the solvent effect on the intensity of light absorption .... See Entry 65908

Recent developments in photoelectron dynamics using synchrotron radiation .... See Entry 65931

33.80B Level crossing and optical pumping

Quantum beats in the fluorescence of jet-cooled SO_2 ($\tilde{A}^1A_2$) under a weak magnetic field .... See Entry 66052

Investigation of coherent emission in time-separated fields .... See Entry 66673

33.80E Autoionization, photoionization, and photodetachment

66078 Photodissociation of partially solvated molecules in beams by the picosecond-jet technique: hydrogen bond breakage. P.M.Felker, A.H.Zewail (Arthur Amos Noyes Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5266-8 (15 April 1983).
The authors report the measurement of photodissociation rates of jet-cooled solute-solvent complexes in various stages of solvation. The observation of fluorescence decays as a function of excess vibrational energy for isoquinoline (IQ), IQ-(methanol)*n*, and IQ-(water)*n* complexes reveals threshold behaviour for the decay rates of 1:1 solute-solvent complexes. The thresholds at ~3 kcal/mol provide new information on the breakage of excited state hydrogen bonds. (7 refs.)

66079 Fe emission yield and photoionization of $Fe(CO)_5$ by vacuum-ultraviolet radiation. D.V.Horak, J.S.Winn (Materials & Molecular Res. Div., Lawrence Berkeley Lab., CA, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.265-71 (20 Jan. 1983).
A crossed vacuum-UV photon-$Fe(CO)_5$ molecular beam experiment was used to study the Fe emission and the $Fe(CO)_5$ photoionization yields induced by vacuum-UV photons in the 9-21-eV range. Fe emission from quintet spin states was observed, and the total 2000-8500-Å Fe fluorescence quantum yield was modeled over the 9-14-eV range by a restricted-degrees-of-freedom statistical dissociation model first used to explain Fe fluorescence produced by metastable rare gas collisions. Over this range, absolute cross sections for dissociation into neutrals, dissociation into fluorescing neutrals, and photoionization were determined. (16 refs.)

FTIR spectroscopic studies of the matrix photoionization and photolysis products of methylene halides .... See Entry 65980

Manifestations of the optical activity of molecules in the dipole photoeffect .... See Entry 66077

Electron energy spectrum in low-energy collisions of negative ions and atoms .... See Entry 66120

Influence of nonlinear frequency mixing on multiphoton ionization of gases .... See Entry 66667

33.80G Diffuse spectra; predissociation, photodissociation

66080 Dynamics of photodissociation of HONO at 369 nm: motional anisotropy and internal state distribution of the OH fragment. R.Vasudev, R.N.Zare (Dept. of Chem., Stanford Univ., Stanford, CA, USA), R.N.Dixon.
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.399-402 (15 April 1983).
Anisotropic trnslational and rotational motion is observed in the ground-state hydroxyl radical generated by photolysis of trans-nitrous acid. The OH translational motion, determined from an analysis of Doppler line profiles, shows a sharply peaked velocity distribution with ≈46% of the total available energy (≈10300 cm^{-1}) appearing in OH recoil. The OH internal state distribution, determined from the laser excitation spectrum, is vibrationally and rotationally cold and the two $^2\Pi$ spin-orbit components are not in equilibrium. These results are compared with a simple impulse model for the fragmentation process. (15 refs.)

66081 Direct measurement of CF_3I multiphoton dissociation yield by iodine-laser detection of iodine atoms. I.A.Boriev, E.B.Gordon, A.A.Nadeikin, A.I.Nikitin, V.L.Talrose, A.M.Velichko (Inst. of Chem. Phys., Acad. of Sci., Moscow, USSR).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.407-9 (15 April 1983).
The primary yield of CF_3I multiphoton dissociation under CO_2-laser irradiation has been determined by direct monitoring of iodine atoms using a pulsed iodine laser. The primary yield was found to exceed markedly an observed MPD yield obtained from measurement of the CF_3I consumption not only in CF_3I-N_2 but also in CF_3I-O_2 mixtures. (6 refs.)

66082 Vibrational relaxation and dissociation of strongly excited ozone molecules. V.M.Gordienko, M.S.Dzhidzhoev, V.Ya.Panchenko, V.K.Popov, I.M.Sizova, A.P.Sukhorukov, N.N.Ustinovskii, A.V.Chugunov (M.V. Lumonosov State Univ., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1432-7 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2204-11 (Nov. 1982). [received: May 1983]
A theoretical investigation was carried out of the process of thermalization of vibrationally excited ozone. For time intervals corresponding to $pt>\tau_{VV}$, τ_{VT} the calculated result were in satisfactory agreement with the experimental data obtained by an interferometric method. A theoretical analysis was made of the kinetics of dissociation of ozone by infrared radiation pulses subject to allowance for multistage excitation and collisional mechanisms of the filling of the upper vibrational levels of ozone. The dependence of the average number of absorbed photons on the density of the infrared radiation energy flux at different pressures of O_3 and of the buffer gas O_2 was determined by an optoacoustic method. The results obtained were used to estimate the *q* factor of ozone. (24 refs.)

Rotational analysis and deperturbation of the $C^2\Sigma^+$-$X^2\Sigma^+$ band systems of BeH and BeD .... See Entry 65944

Anomalous rotational state distribution for the O_2 photofragment in the UV photodissoication of ozone .... See Entry 65945

Measurement of the fragment kinetic energy distribution in laser photopredissociation of N_2O^+ .... See Entry 65946

High-resolution Fourier spectrometry of $^{14}N_2$ infrared emission spectrum: extensive analysis of the $B^3\Pi_g$-$A^3\Sigma_u^+$ system .... See Entry 65978

Manifestations of the optical activity of molecules in the dipole photoeffect .... See Entry 66077

Photochemistry in Van der Waals complexes: observation of the intermediate state of the Hg*, Cl_2 reaction .... See Entry 68783

Infrared multiphoton decomposition and energy-dependent adsorption cross sections of chloroethane-d_0, -2-d_1, and -2, 2, 2-d_3 .... See Entry 68784

Infrared multiphoton decomposition of monosilane sensitized by silicon tetrafluoride .... See Entry 68785

33.80K Multiphoton processes

66083 Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{14}NH_3$. P.Shoja-Chaghervand, E.Bjarnov, R.H.Schwendeman (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.287-305 (Feb. 1983).
Transitions in the ν_2 band of $^{14}NH_3$ were recorded by means of an infrared laser microwave two-photon spectrometer. The spectrometer, which uses a minicomputer to step the microwave frequency and record the spectrum, is described. With sample cells outside the laser cavity good lineshapes are obtained, so that the accuracy of frequency measurement was limited by the resettability of the CO_2 or N_2O lasers employed, ~ 0.0002 cm^{-1}. The present data are compared to previously obtained results based on CO_2 or N_2O laser frequencies and to recently reported calculations. Rotational constants derived for the hypothetical inversion-free ground and $\nu_2=1$ states are reported. (28 refs.)

66084 Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{15}NH_3$. P.Shoja-Chaghervand, R.H.Schwendeman (Dept. of Chem., Michigan State Univ., East Lansing, MI, USA).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.306-15 (Feb. 1983).
The frequencies of 60 transitions in the ν_2 vibration-rotation band of $^{15}NH_3$ were measured to an accuracy of ± 0.0002 cm^{-1} by the technique of infrared-microwave two-photon spectroscopy. These frequencies were combined with previous two-photon measurements, with diode laser results, with laser Stark data, and with ground-state inversion frequencies to derive rotational constants for the hypothetical inversion-free ground state and to derive effective rotational constants for the *s* and *a* components of the $\nu_2=1$ state. (17 refs.)

66085 The $\tilde{A}^1A_1$-$\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,2-difluorobenzene. J.M.Hollas, B.J.Langham, H.Musa, T.Ridley (Dept. of Chem., Univ. of Reading, Reading, England).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.405-19 (Feb. 1983).
The two-photon fluorescence excitation spectrum of 1,2-difluorobenzene was obtained with a tunable dye laser calibrated using a combination of the neon optogalvanic spectrum and etalon fringes. The spectrum consists only of A_1-A_1 bands but the use of linear and circular polarization divides the bands into two types. The 0^0_0 type retains its intensity in circular polarization and, rotationally, shows little or no zero-rank contribution. The 5^1_0 (or 14^1_0) type loses much of its intensity in circular polarization and, rotationally, shows a large zero-rank contribution. These observations all accord with the trace of the two-photon transition tensor being close to zero for the 0^0_0 type and large for the 5^1_0 type, the latter type being involved in vibronic interaction which mixes the $\tilde{A}$ and $\tilde{X}$ states. There is strong evidence for Fermi resonance between the 5^1 and $6^1 10^1$ levels. Parts of the one-photon absorption spectrum have been photographed to aid sequence identification and also to look for the 5^1_0, A_1-A_1 transition. This transition is not observed: nor is there any evidence for intensity stealing by b_2 vibrations. (19 refs.)

Two-photon absorption study of Zn(II)tetraphenylporphin: role of a higher excited singlet state of gerade symmetry .... See Entry 66005

Two-photon laser-induced fluorescence studies of HS radicals, DS radicals, and I atoms .... See Entry 66042

Direct measurement of CF_3I multiphoton dissociation yield by iodine-laser detection of iodine atoms .... See Entry 66081

Influence of nonlinear frequency mixing on multiphoton ionization of gases .... See Entry 66667

Infrared multiphoton decomposition and energy-dependent adsorption cross sections of chloroethane-d_0, -2-d_1, and -2, 2, 2-d_3 .... See Entry 68784

33.90 OTHER TOPICS IN MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS

Use of a perfectly conducting sphere to excite the plasmon of a flat surface. I. Calculation of the local field with applications to surface-enhanced spectroscopy .... See Entry 66183

Preferential orientation of formic acid adsorbed on Al oxides .... See Entry 67369

Esters dissociatively adsorb on alumina .... See Entry 68802

34.00 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS

34.20 INTERATOMIC AND INTERMOLECULAR POTENTIALS AND FORCES

(for molecular solids, see 31.70K)

66086 Pseudopotential calculations including core-valence correlation: alkali compounds. P.Fuentealba, L.V.Szentpaly, H.Stoll, F.X.Fraschio, H.Preuss (Inst. fur Theoretische Chem., Univ. Stuttgart, Stuttgart, Germany).
THEOCHEM (Netherlands), vol.10, p.213-19 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Semiempirical pseudopotentials including core-polarization account quantitatively for core-valence correlation and give accurate results even for relativistic molecules. The authors discuss the main spectroscopic constants for molecular ions of the type $A'A^+$ and AH^+ (A′,A: Li to Cs) and for the molecules LiH, NaK, LiF. (43 refs.)

66087 RKRV potential energy curves and dissociation energies of SiSe, CuSe, PbSe & MgCl. M.S.Bapat, T.Manisekaran, N.Sreedhara Murthy (Dept. of Phys., Univ. of Mysore, Mysore, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.958-60 (Dec. 1982). [received: April 1983]
The RKRV turning points for the ground states of SiSe, CuSe, PbSe and MgCl have been calculated, and the dissociation energies have been obtained by the curve-fitting procedure using an empirical potential function with the RKRV potential energy curves. The estimated values of dissociation energies are 5.46 ± 0.13, 2.38 ± 0.08, 3.31 ± 0.12 and 2.70 ± 0.06 for SiSe, CuSe, PbSe and MgCl respectively. (13 refs.)

66088 Potential energy curves & dissociation energy of YO molecule. N.B.Ishwar, M.P.Varma, B.L.Jha (Spectroscopy Lab., Indian School of Mines, Dhanbad, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.992-3 (Dec. 1982). [received: April 1983]
The RKRV potential energy curves of $X^2\Sigma^+$, $A^2\Pi_r$ and $B^2\Sigma^+$ electronic states of the astrophysically important gaseous YO molecule have been constructed using the method of S.V.J. Lakshman and T.V. Ramakrishna Rao (J. Phys. B (GB), vol.4, p.269, 1971). The dissociation energy of the molecule evaluated by the method of Lippincott is found to be 6.78 ± 0.006 eV. (25 refs.)

66089 Hypervirial calculations of Morse oscillator matrix elements [comment and reply]. A.Requena, R.Pena, J.Zuniga (Dept. of Phys. Chem., Univ. of Murcia, Murcia, Spain), J.N.Huffaker.
J. Chem. Phys. (USA), vol.78, no.7, p.4792-4 (1 April 1983).
In a recent paper, Huffaker and Tran (ibid., vol.76, p.3838, 1982) propose the use of the standard techniques of the factorization method to obtain formulas for matrix elements of powers of the quantity $y=1-\exp(-aq)$ for bound levels of a Morse oscillator. Expressions for diagonal and off-diagonal matrix elements of y, y^2, y^3, and y^4 were presented, and the above mentioned authors suggest that matrix elements of y^5, y^6,..., etc. can be obtained by matrix multiplication from those for y through y^4, using a truncated Morse basis. The interest of this determination was pointed out by Huffaker and Tran. Requena et al. propose an alternative method to obtain any matrix element of any power of y, in closed form. The procedure is based on the use of the hypervirial relationships, formulated by choosing appropriate operators to generate, in a very simple form, a recursion formula by means of which it is possible to obtain the matrix elements of the Morse oscillator in an efficient and quick way, from those for the first and second power of y. Huffaker responds to Requena et al.'s comment, acknowledging a typographical error and discussing the formulae for the matrix elements. (9 refs.)

66090 Intermolecular attractive forces in triplet excimers: *L*-shaped excimer of naphthalene. B.T.Lim, E.C.Lim (Dept. of Chem., Wayne State Univ. Detroit, MI, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5262-4 (15 April 1983).
The authors present the likely geometry of the naphthalene triplet excimer, which allows deductions to be made about the nature of the intermolecular forces which are responsible for the formation of triplet excimers. In order to more exactly define the conformation of the naphthalene triplet excimer, the authors have compared the emission characteristics of naphthalene, 1-methylnaphthalene, and 1,*n*-di-α-naphthylalkanes with those of the rigid symmetric model compound of the dinaphthylmethane, cis-6*b*, 12*b*-dihydroacenaphth(1,2-α)acenaphthylene^{20} (hereafter referred to as the Agosta dimer). (28 refs.)

66091 The He-O_2 anisotropic van der Waals potential from the interplay of theory and scattering experiments. M.Faubel, K.H.Kohl, J.P.Toennies (Max-Planck-Inst. fur Stromungsforschung Gottingen, Germany), F.A.Gianturco.
J. Chem. Phys. (USA), vol.78, no.9, p.5629-36 (1 May 1983).
The interaction of helium atoms with ground state O_2 molecules is examined over a wide range of internuclear distances that fully sample the extension of the shallow well region. A previous multiproperty study of its spherical part is extended to obtain the shape of its anisotropic behavior accurately by a best-fit procedure which involves very precise state-to-state measurements of rotationally inelastic cross sections and IOSA calculations of total and partial differential cross sections. The final form of the interaction is discussed and analyzed with respect to previous findings for similar systems. (22 refs.)

66092 Correlation of zero-point energy with molecular structure and molecular forces. I. Development of the approximation. T.Oi, T.Ishida (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).
J. Phys. Chem. (USA), vol.87, no.6, p.1067-73 (17 March 1983).
An approximation formula for the zero-point energy (ZPE) has been developed on the basis of C. Lanczos' τ method (1956), in which the ZPE has been expressed in terms of the traces of positive integral powers of the FG matrix. It requires two approximation parameters, i.e. a normalization reference point in a domain of vibrational eigenvalues and a range for the purpose of expansion. These parameters have been determined for two special cases as well as for general situation at various values of a weighting function parameter. The approximation method has been tested on water, carbon dioxide, formaldehyde, and methane. The relative errors are 3% or less for the molecules examined, and the best choice of the parameters moderately depends on the frequency distribution. (25 refs.)

66093 Constant of the second $O_g{}^+$ ion-pair state of I_2. J.C.D.Brand, A.R.Hoy (Dept. of Chem., Univ. of Western Ontario, London, Ontario, Canada).
J. Mol. Spectrosc. (USA), vol.97, no.2, p.379-86 (Feb. 1983).
The second $O_g{}^+$ ion-pair state of I_2 is characterized using two-stage polarization-labeling spectroscopy. Molecular constants for this state in the range $0 \leq \nu \leq 25$, based on a global least-squares fit of 450 transitions are (in cm^{-1}) $T_e=47025.917$, $\omega_e=104.1804$, $\omega_e x_e=0.21324$, $\omega_e y_e=2.46 \times 10^{-4}$, $B_e=2.08042 \times 10^{-2}$, $\alpha_e=5.728 \times 10^{-5}$, $\gamma_e=5.8 \times 10^{-8}$, and $D_e=3.32 \times 10^{-9}$. The diabatic potential curve correlates with the states $I^-(^1S)+I^+(^3P_0)$ of the separated ions. (16 refs.)

The calculation of potential energy curves of diatomic molecules: the RKR method .... See Entry 64630

Influence of an abrupt drop in potential on particle motion .... See Entry 64757

Accurate ab initio potential curves using bond functions .... See Entry 65871

Quantum-chemical determination of additive bond polarizabilities in polyatomic molecules .... See Entry 65878

Interaction between two Co atoms. An all electron ab initio HF-CI investigation .... See Entry 65893

Solvent effect on the correlation between dipole increment and complexation enthalpy in charge transfer complexes .... See Entry 65907

Potential energy curves and dissociation energy of monochlorides of beryllium magnesium and calcium .... See Entry 65910

Halogen-substituted amides. IV. Normal coordinate treatment of N-methylcarbamoyl bromide .... See Entry 65951

Sum and density of states for anharmonic polyatomic molecules. Effect of bend-stretch coupling .... See Entry 65956

Infrared and Raman study of the interaction between methyl acetate and phenol derivatives .... See Entry 65973

High-resolution Fourier spectrometry of $^{14}N_2$ infrared emission spectrum: extensive analysis of the $B^3\Pi_g$-$A^3\Sigma_u^+$ system .... See Entry 65978

Spectroscopic studies of pyrazine in cryogenic solutions .... See Entry 66050

Comment on 'recent determinations of potassium ion-rare gas potentials' .... See Entry 66096

Time-independent energy-sudden transformation .... See Entry 66097

Ion-atom collision-induced absorption .... See Entry 66099

34.40 ELASTIC SCATTERING OF ATOMS AND MOLECULES

On the complex angular momentum theory of scattering .... See Entry 65078

34.50 INELASTIC SCATTERING OF ATOMS AND MOLECULES

66094 Atomic collisions in the presence of strong radiation fields: an introductory survey. G.P.Arrighini (Istituto di Chimica Fisica, Univ. di Pisa, Pisa, Italy), C.Guidotti.
THEOCHEM (Netherlands), vol.10, p.49-74 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The action of a strong radiation field from a laser source is expected to influence collision processes, frequently to a substantial degree, through the enhancement of channels already accessible and/or the opening of new ones. An introductory excursion in this area is offered, which emphasizes the role of 'dressed' electron-field potential energy surfaces and transitions between them as a key for understanding the occurrence of processes in the domain of a laser assisted chemistry. (68 refs.)

66095 The propensity rules re-examined: evidence for a long-lived complex in alkali diatomic-rare-gas collisions. M.S.Mehde, F.J.M.Al-Imarah, A.J.McCaffery (School of Chem. & Molecular Sci., Univ. of Sussex, Brighton, England).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.595-8 (22 April 1983).
When $\Delta J=\pm 1$ collision-induced transitions in Π states of excited alkali diatomics are examined over a wide range of pressures several curious phenomena are observed. With the heavier rare gases the authors find that the ± propensities reverse as pressure increases, and the circular polarisation of the parent line first decreases with increasing pressure and then begins to rise, the change-over occurring at roughly the same pressure as the reversal $\Delta J=\pm$ collision propensities. A recently proposed theoretical model involving the formation of a long-lived atom-diatomic collision complex or Feschbach resonance is involved to explain these unusual experimental results. (17 refs.)

66096 Comment on 'recent determinations of potassium ion-rare gas potentials'. F.E.Budenholzer, E.A.Giasalson, A.D.Jorgensen (Dept. of Chem., Univ. of Illinois, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5279-80 (15 April 1983).
In 1977 the present authors reported intermolecular potentials $V(R)$ for the five K^+-rare gas systems determined from molecular beam total cross section measurements. Recently, two other groups have published potentials for these systems. The first study, by Waldam and Gordon (1979) involved theoretical calculations using an electron gas model. The second determination by McDaniel and utilized a direct inversion of ion mobility data, and results were obtained for K^+ with Ar, Kr, and Xe. In some instances, there is considerable disagreement between the electron gas and the mobility results, and it is of interest to compare them with the present authors results obtained by a different method. (10 refs.)

66097 Time-independent energy-sudden transformation. Shi-Liang Ding, R.E.Wyatt (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5627-42 (1 May 1983).
The time-independent energy sudden (ES) representation is defined through application of the energy shift operator $S=\exp[-(h-\omega_n)\partial/\partial\epsilon]$, where h is the internal (molecular) Hamiltonian. The introduction of S follows from an earlier study by Chang, Eno, and Rabitz (1980) where $\exp[-iht]$, which 'factors out' internal motion, was used to define the time-dependent ES representation. Exact integral equations for the scattering wave function within the ES representation are derived, the leading terms being the approximate ES wave function. Corrections to the ES wave function are nonsingular and involve the generalized potential increment $V=S^{-1}VS-V$, where V is the interaction potential. Boundary conditions and transition amplitudes are discussed, as is the connection between wave functions in the ES and the original representations. (11 refs.)

66098 Termolecular ionic recombination at high ambient gas density. D.R.Bates (Harvard-Smithsonian Center for Astrophys., Harvard Univ., Cambridge, MA, USA).
J. Phys. B (GB), vol.16, no.9, p.L295-7 (14 May 1983).
The importance of diffusion relative to drift in ion-ion recombination is a decreasing function of the separation between the ions (contrary to a common supposition). Langevin's formula for the recombination coefficient is obtained very simply using a physical model which allows for both diffusion and drift. (10 refs.)

66099 Ion-atom collision-induced absorption. D.Rogovin (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), P.Avizonis, J.Filcoff.
Opt. Lett. (USA), vol.8, no.5, p.268-70 (May 1983).
The authors examine the linear electrodynamics arising from ion-atom collision-induced absorption. For this situation, induced absorption is achieved by means of long-range electrostatic forces, and the resulting spectral lines are relatively intense, symmetrical, and narrow. As a specific application, the authors examine the $^3P_0\rightarrow{}^1S_0$ forbidden transition of Sn, which is induced to absorb by collision with I^-. The resultant lines are of the order of 15 cm^{-1} wide, and the collision-induced absorption coefficient is 0.45%/cm per Torr of Sn and per 0.1 Torr of I^-. (11 refs.)

A recurrence relation for the phase shifts of exponential and Yukawa potentials .... See Entry 64726

Comprehensive theory for line broadening in high-resolution and nonlinear spectroscopies: application to the Na D lines .... See Entry 65924

Collisional effects on the rovibrational transitions of the HD fundamental band .... See Entry 65963

The translational-rotational absorption spectrum of hydrogen .... See Entry 65969

Collision-induced absorption in ethane-rare gas mixtures .... See Entry 65970

Collisional broadening of nitrous oxide transition lines in the $\nu_1+2\nu_2$ band by noble gases .... See Entry 66073

Atomic orbital expansion study of electron capture in H^++Li and $He^{2+}+Li$ collisions .... See Entry 66131

Laser-induced charge exchange at thermal energies .... See Entry 66133

The effect of atomic structure on potential energy crossings of the multicharged ion-hydrogen atom system .... See Entry 66134

34.50E Rotational and vibrational energy transfer

66100 Vibrational kinetics of CO_2 during intense excitation of Fermi resonance modes. A.A.Likal'ter (High Temperature Inst., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.506-11 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.614-20 (July-Aug. 1982). [received: April 1983]
A conservation equation is derived for Fermi resonance mode quanta which allows for the the flux of excitations from a region of quasiequilibrium to a region characterized by a Boltzmann molecular vibrational quantum number distribution. At high vibrational Fermi resonance model temperatures, this excitation flux is decisive in establishing quantum balance. (11 refs.)

66101 Convergence and memory effects in stochastic treatment of collisional energy transfer. A.J.Makowski, C.S.Lin (Dept. of Chem., Univ. of Windsor, Windsor, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.7, p.4728-33 (1 April 1983).
Second and fourth order Markovian (M) and non-Markovian (NM) equations were solved analytically for stochastic treatment of collinear collision between two identical diatomic molecules. It is shown that when $\nu/2\omega L\ll 1$ is satisfied the Markovian approximation (omission of memory) is sufficiently valid and all four approximation methods (2M, 4M, 2NM, 4NM) show good agreement with exact semiclassical theory. Convergence of the transition probabilities vs. perturbation expansion of potential is slow and nonmonotonic. However, case by case, non-Markovian approximation gives a faster convergence than the Markovian. (19 refs.)

66102 Pulsed molecular beam study of state-to-state vibrational excitation in $He+I_2$ collisions: energy dependence of the $v=0\rightarrow 1$ cross section. G.Hall, K.Liu, M.J.McAuliffe, C.F.Giese, W.R.Gentry (Chem. Dynamics Lab., Univ. of Minnesota, Minneapolis, MN, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5250-1 (15 April 1983).
Reports measurements of the energy dependence of the state-to-state total cross section for vibrational excitation in a neutral-neutral system, $He+I_2$. These results represent the first published data from a new crossed, pulsed molecular beam apparatus designed for both total and differential cross section measurements. The inelasticially scattered I_2 was detected by laser-induced fluorescence (LIF). (6 refs.)

66103 Temperature dependence of intermolecular vibrational energy transfer in the two-channel cyclopropane-1,1-d_2 system. Neon bath gas. V.V.Krongauz, B.S.Rabinovitch, E.Linkaityte-Weiss (Dept. of Chem., Univ. of Washington, Seattle, WA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5643-5 (1 May 1983).
The competitive, two-channel cyclopropane-1,1-d_2 isomerization to propylene has been used for the study of the temperature dependence of vibrational energy transfer efficiency. This note reports work with Ne bath gas at 823 and 1050K. The fall-off region was $k/k_\infty\approx 0.01$. The average amount of energy $<\Delta E>$ transferred per collision with Ne from activated cyclopropane-1,1-d_2 molecules declines with temperature rise, from 575 cm^{-1} at 823K to 275 cm^{-1} at 1050K. The relative efficiency of collisions β_w declines from 0.062 at 823K to 0.012 at 1050K. (12 refs.)

Vibrational excitation following the S1s core ionization of CS .... See Entry 65863

Effects of molecular rotation on electronic relaxation processes in pyrazine and pyrimidine with particular regard to pressure dependence .... See Entry 66053

Statistical limit of S_1 pyrimidine quenching .... See Entry 66055

Correspondence between rotational relaxation and collision-induced intersystem crossing in S_1 pyrimidine .... See Entry 66056

Laser-induced fluorescence and inelastic collisions of KH molecule .... See Entry 66057

Vibrational relaxation and dissociation of strongly excited ozone molecules .... See Entry 66082

34.50H Electronic excitation and ionization (inc. beam-foil excitation and ionization)

66104 Reactions of chemically produced $O_2(^1\Delta)$ with Pb atoms. J.Bachar, S.Rosenwaks (Dept. of Phys., Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.526-31 (22 April 1983).
The potential of the chemical $O_2(^1\Delta)$ generator as a means of electronic excitation of metal atoms and oxides is demonstrated in a study of the reactions of $O_2(^1\Delta)$ with Pb. The resonant energy transfer process, $Pb(^3P_0)+O_2(^1\Delta)\rightarrow Pb(^3P_1)+O_2(^3\Sigma)$, is found to be the key for producing excited Pb and PbO. (24 refs.)

66105 Radiative electron capture (REC) as an indicator of the K-vacancy state of highly ionized projectiles in solids: application to stopping power. S.M.Shafroth (Univ. of North Carolina, Chapel Hill, NC, USA), K.Shima, T.Ishihara, T.Mikumo, T.Miyoshi, T.Mamoi, M.Moriyama, H.Ohara, Y.Tagishi, H.Yamaguchi, M.Yamanouchi.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1055-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Radiative electron capture (REC) has been studied at the Tandem Accelerator Center, Tsukuba University. The NEC 12 UD tandem and sputter ion source provided beams of Cl^{q+} ranging from 17+, 16+, 10+, 8+ and 7+ at energies of 120,95 and 80-MeV which were incident on C targets of varying thickness. The object of this work was to extend to higher energies and charge states the REC target thickness studies which had been done at TUNL. The data on REC cross sections, centroid energies and widths vs. target thickness are given and discussed qualitatively. The relevance of such studies to target thickness dependence of stopping power is demonstrated. (10 refs.)

66106 Charge state distributions of 1 to 7 MeV C and Be ions stripped in thin foils. M.Ch. Stoller, R.Suter, G.Himmel, G.Bonani, M.Nessi, W.Wolfli (Lab. fur Kernphys., NETH, Zurich, Switzerland).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1074-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The authors determine the charge state distrubtions of Be and C ions passing through thin C-foils at energies between 1.5 and 7 MeV. Both C and Be are of interest in todays efforts of using accelerators as mass spectrometers for rare radioisotopes (^{14}C and ^{10}Be in this case). The measurements have shown that the charge state distributions measured with carbon ions are independent of the ion mass at equal velocity. The measured fractions agree reasonably well with the model of Marion (1968). The Be results clearly show the disadvantage of using molecular ions in the accelerator. Unfortunately with present sputter ion sources yields of Be^- beams are very low, whereas the use of BeH^- ions, for which the effect of the Coulomb explosion is small, is hampered by technical problems of producing samples and of obtaining reliable beams. (8 refs.)

66107 Unified theory of ion-impact and shake-off contributions to multiple vacancy production. R.L.Becker (Phys. Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA), A.L.Ford, J.F.Reading.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1076-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
In collisions of atoms with a photon, electron, or proton the projectile usually makes at most a single hole; additional vacancies may be weakly produced by 'shake-off' resulting from a sudden change in the Hartree-Fock potential. With projectiles of nuclear charge greater than one the probability for impact ionization of both K shell electrons is increased. For K_α hypersatellites (K^2L^v) the change in the potential is much greater than for the satellites (KL^v), and L-shell shake-off may be expected to be appreciable in light atoms. The authors have extended their independent-Fermi-particle treatment of ion-impact multiple vacancy production to include shake-off. Calculations for He and C ions on neon exhibit large shake-off contributions for K^2L^v and non-negligible ones for KL^v. (5 refs.)

66108 Exploring the Born series with ion-atom collisions. J.F.Reading, A.L.Ford, S.Smith (Dept. of Phys., Texas A&M Univ., College Station, TX, USA), R.L.Becker.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1079-82 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The work of Brandt and his co-workers (1966, 1973, 1974, 1978) focused attention on corrections to the first Born approximation needed to reproduce experimentally measured low energy ionization cross sections. By varying the charge of the target nucleus Z_N and the charge of the projectile, Z_p, Brandt explored the Born series and introduced the concepts of increased binding, polarization, and Coulomb deflection. Another scheme for correcting the Born approximation is due to Glauber. This method has been applied to electron and proton scattering by Franco and his collaborators (1971). The theoretical basis for both these pictures is reviewed in the light of accurate numerical calculations of excitation and ionization. (8 refs.)

66109 Target recoil effects for inner-shell ionization in ion-atom collisions. A.L.Ford, J.F.Reading (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1083-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Calculations are reported that show the effect of target recoil on K-shell ionization in ion-atom collisions. Target recoil effects are significant in low-energy and small impact parameter collisions, for which Coulomb deflection and corrections to the first Born approximation (increased binding) are also quite important. The non-inertial recoil term that arises when the hamiltonian is written in target-centered coordinates has been discussed in the literature already by several authors. The authors' contribution is to include this finite target mass effect in their large basis coupled-state calculations, which then incorporate effects of recoil, Coulomb deflection, and target orbital perturbations and couplings in a consistent and accurate manner. Results for ionization probability as a function of impact parameter are presented and compared to experiment for several collision energies, projectiles (of different mass and charge), and targets. (16 refs.)

66110 Using nuclear resonance excitation to observe united atoms in symmetric ion-atom collisions. J.Feagin (Behlen Lab., Univ. of Nebraska, Lincoln, NE, USA), L.Kocbach.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1086-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The authors consider nuclear resonance excitation as a means to observe the distribution of united-atom orbitals in symmetric ion-atom collisions. They develop this possibility with the application of a two-state adiabatic model to an analysis of a ^8Be nuclear resonance experiment. To test their model, and to provide a more direct determination of the nuclear resonance width, they propose that the ^8Be experiment be repeated with metastable helium targets. (12 refs.)

66111 Lifetimes and fluorescence yields of states produced in heavy ion-atom collisions. C.P.Bhalla (Dept. of Phys., Kansas State Univ., Manhattan, KS, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1093-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Recent theoretical results for few-electron metastable states are presented along with the experimental data. Average fluorescence yields are given for different atomic numbers. (6 refs.)

66112 Observation of $N_2{}^+$ 3914 Å-band emission in collisions of singly- and doubly-charged Ar, Kr and Xe ions with N_2 at keV energies. A.Matsumoto, T.Sano, T.Iwai (Dept. of Liberal Arts, Kansai Medical Univ., Osaka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1173-7 (April 1983).
The $N^+{}_2$ first-negative-band emission ($B^2\Sigma_u{}^+ \rightarrow X^2\Sigma^+{}_g$; $\Delta v=0$) has been observed in collisions of Ar^{q+}, Kr^{q+} and Xe^{q+} ($q=1$ and 2) with N_2 molecules at the collision energies of 2-8 keV. The relative emission cross-sections for the projectile ions are discussed in connection with the exothermicity of the one-electron capture process, $A^{q+}+N_2 \rightarrow A^{(q-1)+}+N_2{}^+(B^2\Sigma^+{}_u)$. (18 refs.)

66113 Ionisation of fast Rydberg ions in collision with target atoms. D.Roschenthaler, H.D.Betz, J.Rothermel (Sektion Phys., Univ. Munchen, Garching, Germany), D.H.Jakubassa-Amundsen.
J. Phys. B (GB), vol.16, no.8, p.L233-7 (28 April 1983).
Rydberg ions with orbital dimensions up to approximately 1000 a_0 are found to traverse thin gas targets fairly undisturbed, indicating relatively small ionisation cross sections σ_i. Theoretical estimates which take into account screening of target nuclei reveal that $\sigma_i(n)$ becomes asymptotically independent of principal quantum number n. (13 refs.)

66114 Radiative decay of lithium-like ions following charge exchange collisions of 3 keV amu^{-1} C^{4+} ions with H_2. S.Bliman (DRFC/SIG, CENG, Grenoble, France), J.J.Bonnet, G.Chauvet, S.Dousson, D.Hitz, B.Jacquot, E.J.Knystautas.
J. Phys. B (GB), vol.16, no.8, p.L243-5 (28 April 1983).
The distribution of captured electrons in the 3.3 keV amu^{-1} $C^{4+}+H_2 \rightarrow C^{3+*}(n,l)+H_2{}^+$ is studied by detection of the subsequent far UV radiation. Strong lines are observed. Assuming that capture to the $n=3$ manifold dominates at this energy, a relative population of the l sublevels which decreases with the value of l is obtained. (11 refs.)

66115 Oscillatory total cross sections in the $(He\text{-}Ne)^+$ collision system: I. Optical study of $He(3^1P)$ exchange excitation (30-2000 eV).. J.P.Grouard, J.L.Montmagnon (Lab. de Phys. de Optique Corpusculaires, Univ. Pierre et Marie Curie, Paris, France).
J. Phys. B (GB), vol.16, no.8, p.1393-508 (28 April 1983).
The relative emission cross section for He 3^1P exchange excitation in He^+ Ne collisions has been measured in the low-energy range (30 eV-2 keV). When the data, including data obtained with a linear polariser, are plotted as a function of inverse impact velocity, a system of at least four different series of Rosenthal-type oscillations is observed. Their origin is discussed within the framework of the diabatic correlation diagram for the $(He\text{-}Ne)^+$ system. (21 refs.)

66116 L X-ray anisotropy and L_3-subshell alignment of heavy atoms induced by ion impact. W.Jitschin, R.Hippler, R.Shanker (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany), H.Kleinpoppen, R.Schuch, H.O.Lutz.
J. Phys. B (GB), vol.16, no.8, p.1417-31 (28 April 1983).
The anisotropy emission of the Ll X-ray line from heavy atoms ($54 \leq Z_2 \leq 92$) has been investigated experimentally for ion impact ($1 \leq Z_1 \leq 79$) in the energy range 0.15 to 10 MeV amu^{-1}. In the case of single ionisation, the collisionally induced alignment of the L_3 subshell can be derived. The data for H and He projectiles are reasonably well described by direct Coulomb ionisation theories. With increasing Z_1, the measured anisotropy becomes considerably smaller than for H impact. No pronounced dependence on the projectile nuclear charge is found although for different projectiles different ionisation mechanisms (direct ionisation, promotion of molecular orbitals) dominate. (44 refs.)

66117 Direct ionisation of the 4fσ molecular orbital in slow ion-atom collisions. U.Wille (Hahn-Meitner-Inst., KFA Berlin GmbH, Berlin, Germany).
J. Phys. B (GB), vol.16, no.9, p.L275-9 (14 May 1983).
The united-atom ionisation model of Briggs (1975) is applied to direct ionisation of the highly promoted 4fσ molecular orbital. The coherence of the amplitudes corresponding to projectile and target nucleus is fully taken into account. For cases in which a first-order treatment is inadequate, a simple non-perturbative generalisation of the Briggs model is proposed and applied. Results of numerical calculations for Ag+Ag and I+Ag collisions are discussed in the light of recent experiments. (17 refs.)

66118 K and L X-ray excitation in very-heavy-ion-atom collisions near K-L level matching. A.Warczak, D.Liesen, D.Maor, P.H.Mokler, W.A.Schonfeldt (GSI Darmstadt, Darmstadt, Germany).
J. Phys. B (GB), vol.16, no.9, p.1575-94 (14 May 1983).
Impact parameter dependences and total cross sections for K and L X-ray production have been measured near K-L level matching conditions at 1.4 MeV/N projectile energy. Comparing different collision systems ($Z_1>Z_2$ and $Z_1<Z_2$ with $Z_1+Z_2 \gtrsim 100$) the features of those processes which contribute to the excitation are discussed within existing models. (43 refs.)

66119 Excitation cross sections of the spectral lines of the doubly charged yttrium ion. A.N.Kuchenev, Yu.M.Smirnov (Moscow Power Inst., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.759-61 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.90-2 (Aug. 1982). [received: April 1983]
The transitions in a doubly charged yttrium ion (direct excitatino with double ionization) has been investigated using the method of intersecting beams with a modulated electron beam. The excitation cross sections for twelve lines of Y III for an energy of the exciting electrons of 50 eV and a monokinetic spread of the electron beam of about 1 eV have been measured. The optical excitation functions for five lines in the electron energy band from the threshold value to 250 eV has been recorded. (3 refs.)

66120 Electron energy spectrum in low-energy collisions of negative ions and atoms. Yu.F.Bydin, Yu.N.Demkov (V.I. Ul'yanov Leningrad Electrotech. Inst., A.A. Zhdanov Leningrad State Univ., Leningrad, USSR).
Sov. Phys.-Usp. (USA), vol.25, no.7, p.453-74 (July 1982). Translation of: *Usp. Fiz. Nauk (USSR)*, vol.137, no.3, p.377-414 (July 1982). [received: April 1983]
The theory for electron detachment in low-energy collisions of negative ions and atoms and experimental methods for studying this detachment are reviewed. Theory and experiment are compared, particularly with regard to the energy spectra of the emitted electrons. The relationship between electron detachment and nonequilibrium processes in plasmas is discussed, as is the relationship between detachment and the occupation of highly excited states of the colliding particles. The typical parameters of the process, the possibility of extracting them from theory and experiment, and the various theoretical methods and models for detachment and ionization are all discussed. The excitation and decay of approximately stationary states (autoionization and autodetachment states) of quasimolecules and also of isolated atoms and negative ions are discussed. Isotopic effects and the corresponding theory are discussed. Information on the behavior of unstable terms of the colliding atomic particles and of the widths of these terms cannot be obtained by other methods, so that this branch of the physics of atomic collisions may be singled out for separate discussion as the 'electron spectroscopy of unstable quasimolecular states'. (106 refs.)

The quartet system of Li I .... See Entry 65916

Transitions in multiply excited F VI and F VII .... See Entry 65917

Ar L-MM Auger spectra in $Ar^{3+}+Ar$ collisions .... See Entry 65941

Theory of impact broadening of the rotational ammonia spectrum ....
.... See Entry 66074

Low-energy scattering of charged particles .... See Entry 66132

34.50L Chemical reactions, energy disposal, and angular distribution, as studied by atomic and molecular beams

(see also 31.70F and 82.20K Potential-energy surfaces, 82.40D Beam reactions)

Pulsed molecular beam study of state-to-state vibrational excitation in $He+I_2$ collisions: energy dependence of the $v=0 \rightarrow 1$ cross section ......See Entry 66102

34.70 CHARGE TRANSFER

(see also 82.30 Charge transfer reactions)

66121 Solvent motion controls the rate of intramolecular electron transfer in solution. E.M.Kosower, D.Huppert (Dept. of Chem., Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.433-5 (15 April 1983).
The fluorescence decay times (τ_F) for conversion (by intramolecular electron transfer) of the $S_{1,np}$ state into the $S_{1,ct}$ state of 6-(4-methylphenyl)amino-2-naphthalenesulfon-N,N-dimethylamide (TNSDMA) correlate well with the constant-charge dielectric relaxation times $[\tau'_1=(\epsilon_\infty/\epsilon_S)\tau_1]$ in linear alcohols. Solvent motion thus controls certain intramolecular electron transfers. (15 refs.)

66122 Model calculation of the intrinsic barrier for proton transfer in a carbon acid. H.Z.Cao, M.Allavena, O.Tapia, E.M.Evleth (Centre de Mecanique Ondulatoire Appl., Paris, France).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.458-63 (15 April 1983).
The intrinsic energy barrier for proton transfer in a model carbon acid-base system, $H_3O^+ + CH_2=CH_2$, is calculated. The role of basis sets, correlation energy, and solvation are discussed. The results are analyzed within the context of the use of the Marcus equation to characterize proton-transfer kinetics. (35 refs.)

66123 Electron capture into excited states in collisions of highly charged ions with atoms: a theoretical and experimental challenge. R.K.Janev (Inst. de Physique, Beograd, Yugoslavia).
Comments At. & Mol. Phys. (GB), vol.12, no.5-6, p.277-300 (1983).
The current status of the studies on creation of excited states by charge transfer collisions of multiply charged ions with atoms is discussed. Both theoretical and experimental problems involved in these studies are considered and suggestions are made for resolving some of them. (74 refs.)

66124 Measurement of the hyperfine interaction of free ^{75}As ions in H_2, He, Ne, Kr and Xe buffer environments and estimate of collision cross sections in the eV and meV energy region. L.Armbrecht, K.Schutter, L.Ziegeler, I.Borchert (Phys. Inst., Univ. Gottingen, Gottingen, Germany).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.297-305 (Feb. 1983).
With the time-integral perturbed angular correlation (TIPAC) method the pressure dependence of the perturbation of the 121.1-279.5 keV γ-γ cascade in ^{75}As has been investigated using gaseous $H_2{}^{75}Se$ source in different buffer environments. The obtained attenuation coefficients $G_{22}(\infty)$ in the range of 0.55 to 1.0 were fitted with a theoretical stochastic model. In the region of low density, where the correlation time τ_c is large compared to the lifetime τ of the intermediate level of the nucleus, charge transfer collision cross sections have been evaluated between 8.1×10^{-16} cm^2 for He, 1.3×10^{-14} cm^2 for Xe and 1.8×10^{-14} cm^2 for the molecular H_2 buffer gas. For increasing densities of the buffer gases the correlation time τ_c became small compared to the intermediate lifetime τ. The main effect in this region is the depolarization, and the authors found cross sections between 5.2×10^{-15} cm^2 for He, 8.7×10^{-14} cm^2 for Xe and 1.2×10^{-13} cm^2 for the H_2 buffer gas. (15 refs.)

66125 Comments on the molecular complexes of aromatic amines with dinitrobenzenes. P.M.Qureshi.
J. Phys. Chem. (USA), vol.87, no.2, p.372 (20 Jan. 1983).
The author comments on some conclusions made by E.J. Thorne and R.P. Koob (see J. Phys. Chem., vol.84, p.640, 1980), with regard to the role of hydrogen bonding in charge transfer complexes. (10 refs.)

66126 Angular dependence of the probability for Ni K-shell ionisation induced by backscattered protons. Cheng-Ming Fou, M.V.Kratfel, E.C.Benck (Phys. Dept., Univ. of Delaware, Newark, DE, USA), F.Rosel, D.Trautmann.
J. Phys. B (GB), vol.16, no.8, p.1409-15 (28 April 1983).
The probability of Ni K-shell ionisation induced by 2.0, 1.0 and 0.5 MeV protons scattered into $\theta_P=90°$ and 180° has been measured. The results are in good agreement with the theoretical SCA predictions. (7 refs.)

66127 Electron capture into excited states of hydrogen. C.K.Tan, A.R.Lee (Div. of Theoretical & Space Phys., La Trobe Univ., Bundoora, Victoria, Australia).
J. Phys. B (GB), vol.16, no.8, p.1445-59 (28 April 1983).
A simple extension is made to a recent modified binary-encounter approach to calculate the cross sections of electron capture into excited states of hydrogen for protons incident on atomic hydrogen and helium. The present cross sections of electron capture into the nth principal shell of hydrogen compare satisfactorily with experimental result and appear to exhibit an n^{-3} dependence at high impact energy. The shortcomings of previous classical methods are also discussed. A method is suggested for distinguishing electron capture into the excited substrates $H(nl)$. (55 refs.)

66128 Measurements of charge transfer and $^4He^{2+}$ production in collisions between protons and $^4He^+$ ions. B.Peart, K.Rinn, K.Dolder (Dept. of Atomic Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
J. Phys. B (GB), vol.16, no.8, p.1461-9 (28 April 1983).
A coincidence technique has been developed and used to measure the cross sections for charge transfer between protons and $^4He^+$ ions at centre-of-mass energies between 14 and 67 keV. In addition, the range of the authors' previous measurements of cross sections for $^4He^{2+}$ production was extended to 67 keV. Below 14 keV the molecular state calculations of Winter et al. (1980) and Kimuran and Thorson (1981) agree closely with the measurements and, throughout the whole energy range, the recent calculations by Fritsch and Lin (1982) and Winter (1982) are on average, about 15% larger than the authors' results. The absolute accuracy of the measurements is assessed to be ±12%. (16 refs.)

66129 Molecular-state studies of charge transfer in Li^{3+}-H, Be^{4+}-H and B^{5+}-H collisions. M.Kimura (Dept. of Phys., Univ. of Missouri, Rolla, MO, USA), W.R.Thorson.
J. Phys. B (GB), vol.16, no.8, p.1471-80 (28 April 1983).
The authors have performed molecular-state close-coupling calculations of charge transfer cross sections for collisions of the fully-stripped ions Li^{3+}, Be^{4+} and B^{5+} with H(1s) atoms at low to intermediate projectile energies (1 to 15 keV amu^{-1}). Translation factor effects were included using molecular-state switching functions as in previous studies. Calculations with basis sets of different sizes were done for each system to provide a rough estimate of convergence. The results are compared with other theoretical calculations and with available experiments. (31 refs.)

66130 Inner-shell alignment of atoms in ion-atom collisions. III. Light target atoms. V.V.Sizov, N.M.Kabachnik (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
J. Phys. B (GB), vol.16, no.9, p.1565-74 (14 May 1983).
For pt.II see ibid., vol.14, p.2635, 1981. A systematic analysis of experimental data on the alignment of the L_3 vacancy in light atoms formed in collisions with fast ions has been made. Two vacancy production mechanisms were considered: direct Coulomb ionisation and electron capture. The first Born approximation and the Oppenheimer-Brinkman-Kramers approximation, both employing realistic atomic wavefunctions, were used for the calculation of the alignment due to direct ionisation and electron capture, respectively. The results of the calculations are in good agreement with experimental data. (19 refs.)

66131 Atomic orbital expansion study of electron capture in $H^+ + Li$ and $He^{2+} + Li$ collisions. W.Fritsch (Hahn-Meitner-Inst., KFA Berlin GmbH, Berlin, Germany), C.D.Lin.
J. Phys. B (GB), vol.16, no.9, p.1595-603 (14 May 1983).
A modified two-centre atomic orbital expansion is used in an investigation of electron capture in collisions of H^+ and He^{2+} ions with Li atoms. The calculated total and partial transfer cross sections constitute the first published origin-independent results in the energy range 0.5-20 keV for $H^+ + Li$ and in the range 0.1-2.0 keV amu^{-1} for $He^{2+} + Li$ collisions. Total capture cross sections agree well with experimental data wherever the measurements have led to a consistent picture among themselves. For $He^{2+} + Li$ collisions, low-energy capture cross sections are predicted to be much larger than is indicated by results from two-state molecular orbital calculations without translational factors. (21 refs.)

66132 Low-energy scattering of charged particles. R.O.Barrachina, C.R.Garibotti (Inst. Balseiro, Bariloche, Argentina).
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.17, p.583-6 (23 April 1983).
The off-energy-shell T-matrix for two charged particles is studied in the low momentum limit ($k \rightarrow 0$). The T-matrix for a Coulomb interaction (T_C) is usually considered as the limit of the amplitude for a screened potential (T_s) when the screening is removed. The authors show that this statement is not true for small enough energies. For an attractive interaction T_C and T_s differ significantly when $k \rightarrow 0$. T_C behaves as $k^{-1/2}$, while T_s keeps its k^{-1} behaviour even when the screening is turned off. They note that this is an effect which would be observed in ion-atom collisions when one electron is ejected from the atom and captured into a continuum state of the ion. (8 refs.)

66133 Laser-induced charge exchange at thermal energies. V.A.Kartazaev, V.N.Komar.
Opt. & Spectrosc. (USA), vol.53, no.3, p.344-5 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.579-81 (Sept. 1982). [received: May 1983]
The authors consider radiative charge exchange at thermal energies, $A^+ + M + \hbar\omega \rightarrow A + (M^+)^*$, as a transition between terms of a compound system consisting of an initial state ($A^+ + M + \hbar\omega$) and a final state ($A + (M^+)^*$), in the customary approach in descriptions of radiative collisions. By way of an example the authors have calculated the cross section for the Ca^+-Sr system. (11 refs.)

66134 The effect of atomic structure on potential energy crossings of the multicharged ion-hydrogen atom system. I.V.Komarov, A.I.Molotkov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.80-2 (Feb. 1983). In Russian.
The effect of inner electrons of a multicharged ion on potential energy crossings of the Zep system with large internuclear separations is considered. All crossings become pseudocrossings. In the first-order perturbation theory a formula is derived which connects splittings of pseudocrossings with ionic quantum defects and quantum numbers. The role of the ionic core in the general picture of charge transfer is discussed. (3 refs.)

Magnetic field effect measurements by time-selective absorption sampling ....See Entry 64921

Radiative electron capture (REC) as an indicator of the K-vacancy state of highly ionized projectiles in solids: application to stopping power ....See Entry 66105

Charge state distributions of 1 to 7 MeV C and Be ions stripped in thin foils . ...See Entry 66106

Observation of N_2^+ 3914 Å-band emission in collisions of singly- and doubly-charged Ar, Kr and Xe ions with N_2 at keV energies ..See Entry 66112

34.80 ELECTRON SCATTERING

66135 Measurements of the dissociative recombination coefficients of O_2^+, NO^+ and NH_4^+ in the temperature range 200-600K. E.Alge, N.G.Adams, D.Smith (Dept. of Space Res., Univ. of Birmingham, Birmingham, England).
J. Phys. B (GB), vol.16, no.8, p.1433-44 (28 April 1983).
Measurements are presented for α_t, the dissociative recombination coefficients with electrons of O_2^+, NH_4^+ and NO^+ under truly thermalised conditions within the temperature range 200-600K using a flowing afterglow/Langmuir probe apparatus, $\alpha_t(O_2^+)$ is found to vary as $\sim T^{-0.7}$ in close accord with previous pulsed afterglow data for $\alpha_t(O_2^+)$ and $\alpha_e(O_2^+)$ and with values for $\alpha_e(O_2^+)$ inferred from ion trap data. $\alpha_t(NH_4^+)$ is found to vary as $\sim T^{-.06}$. $\alpha_t(NO^+)$ is found to vary as $\sim T^{-0.9}$ which is reasonably consistent with previous pulsed afterglow data for $\alpha_t(NO^+)$. These data are also compared with values of $\alpha_3(NO^+)$ measured in a pulsed afterglow experiment and those derived from ion trap and merged beam cross section data and from atmospheric observations. (32 refs.)

34.80B Elastic scattering of electrons by atoms and molecules

66136 Non-empirical model for the imaginary part of the optical potential for electron scattering. G.Staszewska, D.W.Schwenke, D.Thirumalai, D.G.Truhlar (Dept. of Chem., Univ. of Minnesota, Minneapolis, MN, USA).
J. Phys. B (GB), vol.16, no.9, p.L281-7 (14 May 1983).
The authors propose a new kind of model for absorption of flux from the elastic scattering channel in electron-atom or electron-molecule collisions. It is a non-empirical model so it predicts the absorption cross section as well as the elastic scattering wavefunction and elastic differential cross sections. They have tested the model for electron scattering by He, Ne and Ar at impact energies 30-400 eV. Agreement with experiment is very good for both the absorption cross sections and elastic differential cross sections. (40 refs.)

66137 Relation between the free-free and scattering cross sections and 'two-state resonances' in bremsstrahlung. L.G.D'yachkov, G.A.Kobzev (Inst. of High Temperatures, Acad. of Sci., Moscow, USSR).
J. Phys. B (GB), vol.16, no.9, p.1605-9 (14 May 1983).
The bremsstrahlung cross section (BCS) for electrons scattering on a short-range model potential is expressed in terms of the partial elastic scattering cross sections, $\sigma_1(E)$, for the initial (E_i) and final (E_f) electron energies without the use of the low-frequency approximation. The relation obtained allows a description of the behaviour of BCS close to the scattering resonances. Resonances in the high-frequency limit of bremsstrahlung and 'two-state resonances' (free-free transitions connecting two scattering resonances) are considered. It is shown that in the vicinity of the 'two-state resonance' BCS (considered as a function of the two variables E_i and E_f) behaves as the product of the corresponding partial resonant scattering cross sections $\sigma_{11}(E_i)\sigma_{12}(E_f)$. Resonances in the soft X-ray emission from lanthanum and cerium are discussed. (25 refs.)

66138 Six-state coupled-channel-optical calculation for e-H scattering. I.E.McCarthy, A.T.Stelbovics (Inst. for Atomic Studies, Flinders Univ. of South Australia, Bedford Park, Australia).
J. Phys. B (GB), vol.16, no.9, p.1611-17 (14 May 1983).
The coupled integral equations of the momentum representation are solved for the $n=1,2$ and 3 channels in the e-H system at 54.42 eV. The coupled potential includes polarisation potentials for exciting higher channels from the $n=1$ and 2 channels. Differential cross sections are given for all channels together with angular correlation parameters for the decay of the 2p state. Different approximations are examined for including $n=3$ channels in calculations of scattering data for $n=1$ and 2. (13 refs.)

66139 Total cross section measurements for positron and electron scattering on molecular hydrogen between 8 and 400 eV. A.Deuring, K.Floeder, D.Fromme, W.Raith, A.Schwab, G.Sinapius, P.W.Zitzewitz (Fakultat fur Phys., Univ. Bielefeld, Bielefeld, Germany), J.Krug.
J. Phys. B (GB), vol.16, no.9, p.1633-56 (14 May 1983).
An apparatus for the measurement of positron and electron total cross sections on gases is described. The low-energy positrons are produced by moderating high-energy positrons from β-decay sources. The authors used a ^{11}C positron source, produced at a proton accelerator and, alternatively, a ^{22}Na source, combined with various moderators. For electron measurements the secondary electrons originating from the moderator are used. The beam transport system consists of electrostatic lenses and a weak magnetic lens located in the middle of the gas cell. The discrimination against forward scattering is characterised by a cut-off angle of about 6°. The authors' e^+-H_2 and e^--H_2 data are compared with the results of recent measurements of similar accuracy performed at University College, London, and Wayne State University (Detroit), and with other e^--H_2 data. The agreement is satisfactory. (37 refs.)

66140 Curvilinearity effects in electron diffraction. II. Structure analysis of planar molecules of AB_3 type. A.G.Gershikov (Inst. for Organo-Phys. & Coal Chem., Acad. of Sci., Donetsk, Ukrainian SSR), V.P.Spiridonov, E.Z.Zasorin.
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.1-7 (May 1983).
For pt.I see ibid., vol.75, p.291 (1975). The kinetic model developed in a previous paper (1975) has been extended for the curvilinear bending motion of planar AB_3 type molecules. The curvilinearity contributions to the thermally-averaged distances were estimated and compared with those of stretch anharmonicity and perpendicular amplitude. It is found that the curvilinearity effects are significant and cannot be ignored in precise estimation of r_α (or r_e) parameters from the r_g distances measured by electron diffraction. (36 refs.)

A simple model of a Feshbach resonance ....See Entry 64627

34.80D Atomic excitation and ionization by electron impact

66141 Resonant and nonresonant electron scattering in an inhomogeneous laser field. R.Gayet, H.S.Taylor (Dept. of Chem., Univ. of Southern California, Los Angeles, CA, USA).
Can. J. Phys. (Canada), vol.61, no.4, p.617-28 (April 1983).
Potential electron scattering by atoms immersed in a laser field is investigated in the case where the laser beam presents a strong transverse macroscopic inhomogeneity, due, for instance, to the need of focusing the laser beam. A reasonable model of inhomogeneity is introduced to study the important case where an isolated Feshbach resonance exists. The nonresonant scattering process with a net number N of photons absorbed or emitted is also studied. In a weak field, the inhomogeneity results in the enhancement of the $N=0$ process to the detriment of the others; in addition the probability of the $N\neq0$ process decreases when $|N|$ increases. The decline is more pronounced in a weak inhomogeneous field than in an homogeneous field whose strength is the central strength of the inhomogeneous field. In intense laser fields the situation depends on the value of the field. Similar conclusions are drawn when only the Feshbach resonance is observed. In that case it is shown that a strong inhomogeneity could be an advantage if intense enough central laser fields may be achieved. It could be of help in the search of Feshbach resonances in electron-atom collisions at energies below the first excitation threshold. (7 refs.)

66142 Excitation of the lowest-lying autoionising level in Cs I. S.N.Tiwary (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland).
J. Phys. B (GB), vol.16, no.8, p.L247-9 (28 April 1983).
Electron-impact integral cross sections for the excitation of the lowest-lying autoionising level generated due to the inner-shell excitation $5p^6 6s^2S^e \rightarrow 5p^5 6^{22}P^0$ transition in caesium (Cs) atomic system have been calculated within the Glauber approximation (GA) using single configuration Hartree-Fock (HF) wavefunctions for both initial and final states in the low bombarding energy region. Comparison is made with other avaialble results. (17 refs.)

66143 Measurements of complex scattering amplitudes for electron impact excitation of the 3^1D and 3^1P states of helium. H.B.van Linden van den Heuvell, E.M.van Gasteren, J.van Eck, H.G.M.Heideman (Fysisch Lab., Rijksuniv. Utrecht, Utrecht, Netherlands).
J. Phys. B (GB), vol.16, no.9, p.1619-31 (14 May 1983).
In a scattered-electron cascaded-photon coincidence experiment the authors have studied the electron impact excitation of the in=3 singlet states of helium for incident electron energies between 28 and 46 eV and for a scattering angle of 35°. This was done by measuring the angular distribution of the $3^1P \rightarrow 1^1S$ photons (the later resulting from the $3^1D(3^1S) \rightarrow 2^1P \rightarrow 1^1S$ cascade) in coincidence with the $n=3$ scattered electrons, both in the scattering plane and in the plane perpendicular to the direction of the incoming electrons. At an incident electron energy of 45.6 eV they found a small 3^1D contribution to the coincidence peak. The 3^1P results at this energy are in perfect agreement with previously reported experimental data. At an energy of 34.6 eV this is not the case. At this and lower energies they observe, apart from the dominant 3^1P contribution, a significant 3^1D contribution to the coincidence signal. The authors present new experimental data for the orientation and alignment of both excitations at 34.6, 31.5 and 28.5 eV and for the ratios of the cross sections at these energies. (13 refs.)

66144 Measurement of electron-impact excitation cross section of the germanium atom. P.A.Kolosov, Yu.M.Smirnov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.243-5 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.411-14 (Sept. 1982). [received: May 1983]
The description of an experimental arrangement and method is given for measurement of the electron-impact excitation cross section of atomic germanium. The 1900-6000-Å spectral range was investigated, in which 45 spectral lines of germanium were observed. The results of measurements for the excitation cross sections of the atomic germanium lines as well as typical excitation functions are shown. (4 refs.)

66145 Electron impact ionization of Li^+. A.Roy, K.Roy, N.C.Sil (Dept. of Theoretical Phys., Indian Assoc. for the Cultivation of Sci., Calcutta, India).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.63-4 (11 April 1983).
Triple differential cross sections are calculated for electron impact ionization of Li^+. The different parts of the amplitude involving three Coulomb wave functions have been reduced to one-or two-dimensional integrals in real space. (3 refs.)

Effects of radiative decay on electron-ion cross sections below and above an excitation threshold ....See Entry 65925

Line ratios for O VII ....See Entry 69494

34.80G Molecular excitation, ionization, and dissociation by electron impact

66146 New directions in low energy electron molecule collision calculations. P.G.Burke (Dept. of Appl. Math. & Theoretical Phys., Queen's Univ. of Belfast, Belfast, N Ireland), C.J.Noble.
Comments At. & Mol. Phys. (GB), vol.12, no.5-6, p.301-15 (1983).
Recent trends in the ab initio calculation of low energy electron molecule collision cross sections are reviewed. New methods are being developed which it is hoped will allow accurate results to be obtained for electronic excitation cross sections as well as for rotational and vibrational excitation cross sections for complex molecules. (34 refs.)

66147 Fragmentation of μ_4-oxohexa-μ-nitratotetraberyllium, $Be_4O(NO_3)_6$, under electron impact. R.F.Galimzyanov (V.I. Vernadskii Inst. of Geochem., Acad. of Sci., Moscow, USSR).
Polyhedron (GB), vol.1, no.11-12, p.820-2 (1982).
The behviour of $Be_4O(NO_3)_6$ under electron impact is similar to that of its carboxylato analogues, $Be_4O(RCO_2)_6$ where R is H, alkyl or halogenated alkyl. In all these systems, the dissociation of the molecular ions is dominated by steric interactions. The major fragmentations involve the elimination of N_2O_5 or $(RCOO_2)$ and $Be(NO_3)_2$ or $Be(RCO_2)_2$ from the ions $[M\text{-}NO_3]^+$ or $[M\text{-}RCO_2]^+$. The results obtained confirm the structural similarity of the nitrato complex to tetra-nuclear beryllium oxocarboxylates. (8 refs.)

Total cross section measurements for positron and electron scattering on molecular hydrogen between 8 and 400 eV ....See Entry 66139

35.00 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES

35.10 ATOMS

35.10B Atomic masses, mass spectra, abundances, and isotopes

(inc. isotope separation; for mass spectrometry, see also 07.75; for radioisotope separation see 28.42H or 82.55)

66148 Quantum dynamical model of laser-stimulated isotope separation of adsorbed species: role of anharmonicity, coupling strength, and energy feedback from the heated substrate. J.Lin, T.F.George (Dept. of Chem., Univ. of Rochester, Rochester, NY, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5197-209 (15 April 1983).
A quantum model of a heterogeneous system consisting of a mixture of isotopes adsorbed on a solid surface and subjected to laser radiation is presented. The model system is described by a total Hamiltonian including direct and indirect (surface-phonon-mediated) couplings. The equations of motion are derived in the Heisenberg-Markovian picture in which the many-body effects of the surface phonon modes and the adspecies are reduced to an overall broadening(damping factor) given by the sum of the enerlgy (T_1) and phase (T_2) relaxations. The effects of the dephasing and anharmonicity on the average excitation are investigated. The 'bistability' feature with a red-shifted optimal detuning is discussed in terms of the solution of a cubic equation. A diagonalization procedure is presented in a new basis which reveals the effects of the coupling strength, the frequency difference, and the level width of the isotopes on the total steady-state excitation, which in turn reflects the surface spectrum of the model system. Finally, the isotope selectivity given by the numerical results of the time-integrated excitation is discussed. It is shown that the optimal detuning for a weak coupling strength is further red-shifted for a strong isotopic coupling strength. Finally, energy feedback effects of the bath modes on the excitations of the active modes are investigated by combining a quantum excitation equation and a classical heat diffusion equation. (9 refs.)

Magic numbers for argon and nitrogen cluster ions ....See Entry 66170

Precision measurements of rare radioisotopes with a tandem Van de Graaff accelerator ....See Entry 69372

35.10D Electric and magnetic moments, polarizability

Probabilities for electric quadrupole transitions between Rydberg states of atoms and ions ....See Entry 65930

35.10F Relativistic corrections, fine- and hyperfine-structure constants

66149 Fast beam radiofrequency spectroscopy. F.M.Pipkin (Lyman Lab., Harvard Univ., Cambridge, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1039-42 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The combination of a fast atom or ion beam derived from a small accelerator with radiofrequency spectroscopy methods provides a powerful method for measuring the fine structure of atomic and molecular systems. The fast beam makes possible measurements in which two separated oscillatory fields are used to obtain resonance lines whose widths are less than the natural line width due to the lifetimes of the states. The separated oscillatory field lines have, in addition, a number of features which make possible measurements with greater precision and less sensitivity to systematic errors. The fast beam also makes accessible multiple photon radiofrequency transitions whose line width is intrinsically narrower than that of the single photon transitions and which offer great potential for high precision measurements. This report focuses on the techniques and their promise. Recent measurements of the fine structure of H and He^+ are used as illustrations. (20 refs.)

66150 Nonlinear fast-beam laser interactions. U.Nielsen, O.Poulsen (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1047-50 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
High-resolution spectroscopy performed on fast-moving absorbers has several desirable features. First, in a collinear geometry, the residual Doppler width of the fast atoms is low due to the velocity bunching taking place during acceleration. Second, the velocity of these cooled atoms can easily be changed very precisely. Third, this makes possible Doppler tuning of a laser into resonance with a particular atomic transition. Doppler shifts up to $\simeq$80 Å are present, dependent on the beam energy and the atom used. This, in turn, makes it possible to 'create' completely harmonic three-level atoms, using the relativistic transformation between laboratory and atom rest frame and to perform optical pumping in well defined spatial regions. Applications to velocity control, resonant three-level nonlinear field-atom interactions, high-resolution laser-rf double-resonance spectroscopy, and lifetime determinations are discussed. (21 refs.)

Transitions in multiply excited F VI and F VII ....See Entry 65917

35.10H Ionization potentials, electron affinities

High Rydberg transitions in the principal and intercombination series of mercury ....See Entry 65914

35.20 MOLECULES

(see also 61.55, 61.60, and 61.65 Specific structures of metals and alloys, of other inorganic materials, and of organic materials, respectively)

35.20B General molecular conformation and symmetry; stereochemistry

66151 X-ray structure study of a pyrazolino-cepham (VPNB) $C_{24}H_{23}NB_5O_7S$. K.Simon (Chinoin Res. Center, Budapest, Hungary), Gy.Argay, J.Cs.Jaszberenyi, T.E.Gunda, R.Bognar.
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.9-16 (May 1983).
A tricyclic cepham derivative (VPNB) has been prepared and the relative configuration at the chiral centres C-3, C-4, C-6, C-7 investigated by X-ray analysis. (12 refs.)

Correct representation of conformational equilibria ....See Entry 64632

Ab initio studies of weakly bound complexes between some nonpolar molecules and hydrogen fluoride ....See Entry 65873

Ab initio studies of the CO_2-HF and N_2O-HF complexes ....See Entry 65874

Equilibrium geometry and dynamics of the valence excited states of 1,3-butadiene ....See Entry 65897

Electronic properties of alkali trimers ....See Entry 65911

Vibrational frequencies for silaacetylene and its silylidene and vinylidene isomers [and molecular structures] ....See Entry 65955

Microwave structure measurements on the cyclopropane-HCN complex ....See Entry 65965

Microwave, infrared and Raman spectra and structure of 2-nitropropane ....See Entry 65966

Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate ....See Entry 65967

The characterization of alkali arsenites and antimonites: the IR spectra of matrix-isolated $MAsO_2$ and $MSbO_2$ molecules ....See Entry 65983

Infrared and Raman study and ab initio calculations of internal rotation in methylisopropenyl ether ....See Entry 65984

Conformational analysis of 2-chloro-4-methylpentane and 2-bromo-4-methylpentane ....See Entry 65986

Molecular structure, vibrational spectra and normal coordinate analysis of S-methyl dithiocarbamate ....See Entry 65988

Conformation behaviour of dimethylmethylphosphonate and methyldimethylphosphinate studied by infrared spectroscopy in low-temperature matrices ....See Entry 65990

The spectra and structure of diboron trioxide ....See Entry 65994

PMR spectra of some substituted pyrazines and 2,3-dihydropyrazines ....See Entry 66014

Vibrationally averaged structure of azulene partially oriented in a nematic phase ....See Entry 66016

Nuclear magnetic resonance studies of transition-metal complexes of ethylenediaminetetra-acetic acid (EDTA) in aqueous solution ....See Entry 66029

Structure and photodecomposition reactions of cations of cyclopentane, cyclohexane, cyclic olefines and dienes in γ-irradiated frozen solutions of CF_3CCl_3. An ESR study ....See Entry 66031

Possibility of the investigation of conformational changes in protein molecules with fluorescent probes in the picosecond time range ....See Entry 66062

3-methyl-3-butenenitrile and 3-bromo-2-methyl-1-propene: normal coordinate calculations based on valence force fields ....See Entry 66158

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 ....See Entry 66953

Molecular and crystal structure of ANCAOLAN (crystal I and crystal II) ....See Entry 66972

1,2-dibenzyl- and 1,2-diaryltetrakis(dimethylamido)dimolybdenum and -ditungsten compounds: $M_2R_2(NMe_2)_4$ ($M\equiv M$). Structural effects of Me_2N-to-M π bonding ....See Entry 66975

Structure of anions and neutral molecules of selenazolidine-2,4-dione ....See Entry 66978

Change in molecular conformation and the nature of the nematic-isotropic-liquid phase transition ....See Entry 67208

Comparative studies between monomeric and polymeric sodium 10-undecenoate micelles ....See Entry 68807

Perturbation of the hydrogen-bond equilibrium in nucleic bases. An infrared study ....See Entry 68920

35.20D Interatomic distances and angles

Ab initio studies of the CO_2-HF and N_2O-HF complexes ....See Entry 65874

Interaction between two Co atoms. An all electron ab initio HF-CI investigation ....See Entry 65893

A method for the determination of the inter-charge distance in the doubly-charged ions ....See Entry 65905

Vibrational spectra, isolated CH stretching frequencies and CH bond lengths in CH_3OCH_2X compounds (X=F, Cl, Cr, I) ....See Entry 65987

Solvent dependence of deuteron quadrupole coupling constants and of methyl angles of some CD_3X compounds determined by NMR of partially oriented molecules ....See Entry 66018

Multiple-scattering effects in EXAFS spectroscopy of oxygen-bridge iron complexes. Possibility of angle determination by EXAFS analysis ....See Entry 68359

35.20G Bond strengths, dissociation energies, hydrogen bonding, etc

66152 Chemical bonding in transition metal magnetic molecules and clusters. J.Keller (Facultad de Quimica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
THEOCHEM (Netherlands), vol.10, p.93-110 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The chemical bonding among transition metal atoms in molecules and clusters is strongly dependent on a balance between bonding energy and intraatomic exchange energies. Molecules and clusters may be magnetic either because of the degeneracy of the uppermost occupied levels or because there is a ground state where one or more of the atoms build a localized moment. The author shows strong evidence of the contribution of the d electrons to the bonding and then, because intraatomic exchange is so strong, of the competition between atomic magnetic moments and chemical bonding. The main examples will be Fe, Ni, Mo, Nb and Ir molecules and clusters. The cluster calculations are for groups of atoms in condensed matter boundary conditions. Multiple scattering and local density techniques are used. (19 refs.)

On the basis set superposition error in potential surface investigations. I. Hydrogen-bonded complexes with standard basis set functions ....See Entry 65866

A comment on 'Numerical Hartree-Fock-Slater calculations on diatomic molecules' by A.D. Becke [and addendum] ....See Entry 65869

Ab initio studies of weakly bound complexes between some nonpolar molecules and hydrogen fluoride ....See Entry 65873

Quantum-chemical determination of additive bond polarizabilities in polyatomic molecules ....See Entry 65878

Interaction between two Co atoms. An all electron ab initio HF-CI investigation ....See Entry 65893

On relativistic contributions to the bonding in Cu_2 ....See Entry 65895

Potential energy curves and dissociation energy of monochlorides of beryllium magnesium and calcium ....See Entry 65910

Rotational analysis and deperturbation of the $C^2\Sigma^+$-$X^2\Sigma^+$ band systems of BeH and BeD ....See Entry 65944

Infrared and Raman study of the interaction between methyl acetate and phenol derivatives ....See Entry 65973

Infrared band intensities and bond polarities. Static and rehybridization dipole moment contibrutions to infrared intensities in C_6F_6 ....See Entry 65982

Vibrational spectra, isolated CH stretching frequencies and CH bond lengths in CH_3OCH_2X compounds (X=F, Cl, Cr, I) ....See Entry 65987

Photodissociation of partially solvated molecules in beams by the picosecond-jet technique: hydrogen bond breakage ....See Entry 66078

RKRV potential energy curves and dissociation energies of SiSe, CuSe, PbSe & MgCl ....See Entry 66087

Potential energy curves & dissociation energy of YO molecule ....See Entry 66088

Thermodynamic functions of diatomic selenium ....See Entry 66662

Molecular orbital calculation of several ices using the pseudolattice method ....See Entry 66923

Perturbation of the hydrogen-bond equilibrium in nucleic bases. An infrared study ....See Entry 68920

35.20J Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics

66153 Conformational analysis of seven-membered cyclic systems. G.Favini (Inst. of Phys. Chem., Univ. of Milan, Milan, Italy).
THEOCHEM (Netherlands), vol.10, p.139-52 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Strain energy and quantum mechanical calculations employed in an attempt to determine the geometries and the conformational energies of seven-membered rings are reviewed. Pseudorotational and interconversion modes are

described for cycloheptene, cycloheptane, oxepane, 1,3-dioxepane and their methyl derivatives. The relative energies of the possible conformations of the three isomers of 1,4-cycloheptadiene (cis-cis, cis-trans and trans-trans) and of the two isomers of 1,3-cycloheptadiene (cis,cis and cis-trans) are discussed. A particular attention is turned to the bicyclo|5.1.0|octanes and bicyclo|5.1.0.|octenes by considering the effects on conformational properties of the seven-membered ring due to the condensation of a small ring (cyclopropane or oxirane). (35 refs.)

Degas' dancers: an illustration for rotational isomers .... See Entry 64631

Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate .... See Entry 65967

Millimeter-wave spectrum of ethyl acetylene centrifugal distortion, Coriolis interaction and internal rotation .... See Entry 65968

Infrared and Raman study and ab initio calculations of internal rotation in methylisopropenyl ether .... See Entry 65984

Vibrational spectra and rotational isomerism of 1,2-dimethyldisilane .... See Entry 65992

On the estimation of relaxation contributions to internal motion .... See Entry 66013

Experimental and theoretical approach to molecular dynamics of pyridine derivatives and related molecules from dielectric relaxation measurements. I. 2.3′-bipyridyl in the liquid state .... See Entry 68122

Identification of pentachlorobiphenyl isomers by application of diffuse reflectance Fourier transform infrared spectroscopy .... See Entry 68186

Novel features in the stereochemistry of octacyanides: phase transition in tetra-n-butylammonium octacyanotungstate(V) .... See Entry 68191

35.20M Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility

66154 Effect of the relative velocity on the polarizability of a collision homodiatom. L.Galatry, J.Humbert (Lab. de Phys. Moleculaire, Univ. de Besancon, Besancon, France).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.563-8 (22 April 1983).
The van der Waals induced polarizability in a homonuclear diatom is dependent on the relative velocity of the partners. This effect is introduced through Fourier expansion of the time-dependent internuclear distance, in a calculation of the energy of the pair. This calculation is carried out taking into account the nonlinear third-order polarization of the atoms in the interatomic field and in an auxiliary applied external field. The results contain, in the zero relative velocity limit, that of Hunt, Zilles and Bohr (1981). For nonzero relative velocities, a limited expansion with respect to the relative velocity is proposed. The linear term of this expansion suggests the existence of a weak optical activity for a monatomic fluid submitted to a nonuniform flow. (13 refs.)

66155 The dipole moments of some chloro- and bromopentanes. J.G.Berberian (Dept. of Chem., Saint Joseph's Univ., Philadelphia, PA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5269-70 (15 April 1983).
In the course of a study of the molecular dynamics in supercooled liquids in this laboratory, the need arose for the dipole moments of the compounds under investigation in order to correlate dielectric and steady-state shear viscosity data. The compounds investigated are 3-chloropentane (3CP), 3-chloromethylpentane (3CMP), 3-chloro-3-methylpentane (3BMP), and 3-bromo-3-methylpentane (3B3MP). Since some of these compounds have relatively high boiling points and are thermally labile, their dipole moments had to be determined in solution as opposed to vapour phase measurements. Additionally, the rationale for the use of solution dipole moments values in the study of liquids is that they show the relative dipole strengths among the compounds. Benzene was chosen as the solvent in order to maintain consistency with dipole moment data on other compounds. (10 refs.)

66156 A polynomial fitting procedure for the determination of the moments of NMR lines in polymers from the truncated FID. B.Meurer, P.Spegt, G.Weill (Univ. L Pasteur, Strasbourg, France).
J. Phys. E (GB), vol.16, no.5, p.403-7 (May 1983).
A polynomial fitting procedure (POLFIT) has been developed for the direct calculation of second and higher moments of NMR lines from the FID free induction decay in the time domain. Care must be exercised in taking the proper origin at the middle of the pulse and in choosing the degree of the polynomial given the region of the FID submitted to the fitting procedure. It requires a preliminary optimisation, starting from a theoretical curve with a shape similar to the FID under study. Conditions of stability are found which hold for all dipolar solids, particularly polymers. Extension to the polynomial fitting of a quadrupolar half echo requires a new evaluation of the stability parameters for the strongly oscillating signal. (18 refs.)

On the basis set superposition error in potential surface investigations. I. Hydrogen-bonded complexes with standard basis set functions .... See Entry 65866

Ab initio studies of weakly bound complexes between some nonpolar molecules and hydrogen fluoride .... See Entry 65873

Quantum-chemical determination of additive bond polarizabilities in polyatomic molecules .... See Entry 65878

Nonempirical calculations of magnetic properties by the SOS-CI perturbation theory according to Nakatsuji .... See Entry 65887

Ab initio SCF CI study of the electronic structure and spectrum of CuF_2 .... See Entry 65888

Solvent effect on the correlation between dipole increment and complexation enthalpy in charge transfer complexes .... See Entry 65907

The translational-rotational absorption spectrum of hydrogen . See Entry 65969

Collision-induced absorption in ethane-rare gas mixtures .... See Entry 65970

Infrared band intensities and bond polarities. Static and rehybridization dipole moment contibrutions to infrared intensities in C_6F_6 .... See Entry 65982

Theoretical study of the effects of vibrational-rotational interactions on the Raman spectrum of N_2 .... See Entry 65995

Chemical bonding in transition metal magnetic molecules and clusters .... See Entry 66152

Magnetic properties of a diamagnetic gas in a resonance radiation field .... See Entry 66669

35.20P Rotation, vibration, and vibration-rotation constants

66157 Molecular constants and thermodynamic properties of some planar XY_3-type molecules. A.Dhanalakshmi, P.Kamala, M.Lalitha (Dept. of Phys., Seethalakshimi Ramaswami Coll., Tamil Nadu, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.830-1 (Oct. 1982). [received: April 1983]
The *L-F* approximation method developed by Pandey et al. [Indian J Pure & Appl. Phys., 14 (1976) 815] has been applied to study the force field of three molecules of the planar XY_3-type and the general valence force constants have been evaluated using the latest assignment of Raman and IR frequencies. The mean amplitudes of vibration and the shrinkage effect of the Y...Y bonds have been evaluated. Coriolis coupling constants have been obtained by the method of Meal and Polo. Using the Coriolis coupling constants and the vibrational frequencies, inertia defect has been evaluated by Morino method. The thermodynamic properties of these molecules have also been calculated. (15 refs.)

66158 3-methyl-3-butenenitrile and 3-bromo-2-methyl-1-propene: normal coordinate calculations based on valence force fields. S.H.Schei (Dept. of Chem., Univ. of Trondheim, Trondheim, Norway).
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.327-30 (1983).
Normal coordinate calculations have been made for the actual conformers of the molecules $CH_2\text{-}C(CH_3)\text{-}CH_2X$, $X=C{\equiv}N$, Br. A valence force field of 37(34) force constants reproduced the 33(30) fundamental frequences for $X=X{\equiv}N(Br)$ to an average deviation of 14(11) CM^{-1}. For 3-brom-2-methyl-1-propene the calculation suggests a reassignment. According to this, the existing experimental data may be reinterpreted as 3-bromo-2-methyl-1-propene having 2 conformers, instead of 3 as suggested earlier. (19 refs.)

Sensitivity of V_2' saturation transfer electron paramagnetic resonance signals to anisotropic rotational diffusion with [^{15}N] nitroxide spin-labels. Effects of non-coincident magnetic and diffusion tensor principal axes .... See Entry 64925

On the basis set superposition error in potential surface investigations. I. Hydrogen-bonded complexes with standard basis set functions .... See Entry 65866

Rydberg states with a $^2\Pi$ core: the $b^3\Pi_i$ and $C^2\Pi$ states of DCl .... See Entry 65901

Rotational analysis and deperturbation of the $C^2\Sigma^+\text{-}X^2\Sigma^+$ band systems of BeH and BeD .... See Entry 65944

Anomalous rotational state distribution for the O_2 photofragment in the UV photodissoication of ozone .... See Entry 65945

Measurement of the fragment kinetic energy distribution in laser photopredissociation of N_2O^+ .... See Entry 65946

Vibrational analysis of uranyl tetrachloride complexes .... See Entry 65950

Halogen-substituted amides. IV. Normal coordinate treatment of N-methylcarbamoyl bromide .... See Entry 65951

Mean amplitudes of vibration and Coriolis coupling coefficients of some octrahedral ions .... See Entry 65952

Molecular constants of H_2S and D_2S using harmonic frequencies .... See Entry 65954

Vibrational frequencies for silaacetylene and its silylidene and vinylidene isomers [and molecular structures] .... See Entry 65955

Rotational analysis of the (0-3) band in the 3*A* system of $^{14}C^{16}O$ .... See Entry 65958

cis acrolein: mixing of the S_0 and S_1 electronic states by the (a'') skeletal torsional vibration .... See Entry 65959

Infrared & Raman Spectra of vanillin .... See Entry 65974

Vibrational spectra and force constants of symmetric tops: rovibrational spectra in the ν_3 region of monoisotopic species of H_3GeCl, H_3GeBr, and H_3GeI .... See Entry 65979

Integral emission and absorption characteristics of CO_2 and CO bands in conditions of vibrational disequilibrium .... See Entry 65991

Vibrational spectra and normal coordinate analysis of *p*-bis(dimethylhydroxy-silil)benzene-d_0 and $-d_4$ .... See Entry 65997

Infrared-microwave double-resonance probing of the population-depopulation of rotational states in the NO_2 molecule .... See Entry 66039

Strengths and Lorentz broadening coefficients for spectral lines in the ν_3 and $\nu_2+\nu_4$ bands of $^{12}CH_4$ and $^{13}CH_4$ .... See Entry 66072

Collisional broadening of nitrous oxide transition lines in the $\nu_1+2\nu_2$ band by noble gases .... See Entry 66073

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{14}NH_3$ .... See Entry 66083

Infrared-microwave two-photon spectroscopy of the ν_2 band of $^{15}NH_3$ .... See Entry 66084

The $\tilde{A}^1A_1\text{-}\tilde{X}^1A_1$ two-photon fluorescence excitation spectrum of 1,2-difluorobenzene .... See Entry 66085

Vibrational kinetics of CO_2 during intense excitation of Fermi resonance modes .... See Entry 66100

Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2 .... See Entry 66953

Laboratory measurement of the $4_{04}\text{-}3_{13}$ 70 GHz transition ground-state methylene (CH_2) .... See Entry 69489

35.20S Hyperfine and fine-structure constants

The nuclear hyperfine structure of deuterated ammonia .... See Entry 65964

The ^{13}C hyperfine splittings in ESR spectra of prop-2-ynyl and 1-(trimethylsiloxy)prop-2-ynyl radicals .... See Entry 66033

Study of the radical-cations of triethylamine and benzene derivatives by the optical detection of the EPR spectra of radical-ion pairs .... See Entry 66034

The phosphorescent state of γ-thiopyrones: optically-resolved zero-field splittings .... See Entry 66045

Dependence of selectively excited fine-structure fluorescence spectra of organic molecules on the wavelength of the exciting light .... See Entry 66064

Fast beam radiofrequency spectroscopy .... See Entry 66149

Laboratory measurement of the $4_{04}\text{-}3_{13}$ 70 GHz transition ground-state methylene (CH_2) .... See Entry 69489

35.20V Ionization potentials, electron affinities, molecular core binding energy

66159 Electron affinity of a nitroxide radical. J.E.Bartmess, T.Basso, R.Georgiadis (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
J. Phys. Chem. (USA), vol.87, no.6, p.912 (17 March 1983).
From a thermochemical cycle, an electron affinity of 13.2±6 kcal/mol. is derived for Et_2NO., based on the gas-phase acidity and O-H bond strength of Et_2NOH. This electron affinity is 35 kcal/mol. lower than that of the corresponding alkoxy radical, Et_2CHO.. The gas-phase basicity of Et_2NOH is also reported. (14 refs.)

Accurate ab initio potential curves using bond functions ....See Entry 65871

Ab initio studies of weakly bound complexes between some nonpolar molecules and hydrogen fluoride ....See Entry 65873

Ab initio studies of the CO_2-HF and N_2O-HF complexes ....See Entry 65874

Search for a unique set of parameters in IOC-ω technique .....See Entry 65881

Coordination in benzene dimer cation radical ....See Entry 65882

Evaluation of some molecular properties of Di- & Tri-substituted acetophenones by a (PPP-CI) method ....See Entry 65885

Electronic properties of alkali trimers ....See Entry 65911

Electronic structure of H_n^+ and HeH_n^+ clusters ....See Entry 66172

35.20X Mass spectra

A method for the determination of the inter-charge distance in the doubly-charged ions ....See Entry 65905

Magic numbers for argon and nitrogen cluster ions ....See Entry 66170

35.80 ATOMIC AND MOLECULAR MEASUREMENTS AND TECHNIQUES

Time resolved high resolution spectroscopy using the high frequency deflection technique and supersonic jet targets. I. Instrumental; simplification of spectra; reductions of collisional quenching ....See Entry 64961

Stable atomic hydrogen possible application in intense polarized sources ....See Entry 64994

Atomic hydrogen source with direct helium cooling ....See Entry 64995

Studies of ion beam-photon interactions at the National Synchrotron Light Source ....See Entry 65724

A spin flipper for thermal atomic beams ....See Entry 65765

A compact synchroscan streak camera using a microchannel plate incorporated tube ....See Entry 66046

Photodissociation of partially solvated molecules in beams by the picosecond-jet technique: hydrogen bond breakage ....See Entry 66078

Fast beam radiofrequency spectroscopy ....See Entry 66149

36.00 STUDIES OF SPECIAL ATOMS AND MOLECULES

36.10 EXOTIC ATOMS AND MOLECULES (CONTAINING MESONS, MUONS, AND OTHER ABNORMAL PARTICLES)

66160 Radiative corrections to positronium decay. G.S.Adkins (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Ann. Phys. (USA), vol.146, no.1, p.78-128 (March 1983).
A method for calculating radiative corrections to positronium decay is presented that is direct, and allows for a systematic extension applicable to the calculation of corrections beyond the first $[o(\alpha)]$ correction. An expression for the decay amplitude in terms of the Bethe-Salpeter wavefunction is employed. The Bethe-Salpeter wavefunction is evaluated perturbatively in a scheme having a lowest-order bound state equation that is exactly soluble. The decay amplitude is evaluated in Coulomb gauge, without the introduction of a photon mass. One-loop renormalization in Coulomb gauge is shown to be consistent. Using this method the known analytic result for the $o(\alpha)$ correction to the parapositronium decay rate is obtained. The same method is applied to orthopositronium, and the existing theoretical discrepancy in the value of the $o(\alpha)$ correction to the decay rate is resolved. This $o(\alpha)$ correction is obtained with an error which corresponds to an uncertainty in the total rate much smaller than $\alpha^2\Gamma_{LO}$ (where Γ_{LO} is the lowest-order rate). Also, the $o(\alpha)$ correction to the differential decay rate is computed for the first time. (46 refs.)

66161 Positron annihilation in the positronium negative ion. Y.K.Ho (Dept. of Phys. & Astron., Louisiana State Univ., Baton Rouge, LA, USA).
J. Phys. B (GB), vol.16, no.8, p.1503-9 (28 April 1983).
A theoretical study of positronium negative ions is carried out. Hylleraas-type wavefunctions are employed to describe the system and an improved ground-state energy is reported. In addition, the two-photon annihilation rate and the lifetime against two-photon annihilation are also calculated, as well as the two-photon angular correlation function. (20 refs.)

66162 Two-photon transitions in positronium. A.Quattropani (Inst. de Phys. Theorique, Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland), F.Bassani.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1258-60 (25 April 1983).
The transition-probability amplitudes for absorption of two photons in positronium are computed from the 1^3S_1 ground state to the excited states 2^3S_1 and 3^3S_1 as functions of the frequencies of the photons. Sharp resonances are found in correspondence to the intermediate states and transparencies occur between each two resonances and also before the first resonance in the 1^3S_1-3^3S_1 transition. The detailed structure of the transition probability in proximity of the intermediate ^3P states reproduces the excited-state structure of positronium with inclusion of relativistic and radiative corrections. (9 refs.)

66163 On the lifetime of ortho-positronium (O-Ps) in molecular substances. Zhang Man-wei, Zhang Zhi-cheng (Univ. of Sci. & Technol., Hefei, China).
Radiat. Phys. & Chem. (GB), vol.21, no.4, p.367-73 (1983).
Both the lifetime and the intensity of O-Ps are two useful parameters of molecular substances. In this paper only O-Ps lifetime is discussed. It is considered that the O-Ps lifetime in condensed molecular substances depends predominantly on volume-factors and dielectric properties of materials. However, the chemical and paramagnetic quenching of O-Ps by molecules and active radicals in the spur cannot be neglected, and sometimes affect the O-Ps lifetime considerably. A semi-empirical formula for estimation of O-Ps lifetime is obtained. By comparison between the calculated and experimental values of O-Ps lifetime (τ_3), some predictions about chemical properties and positron radiation affects on materials are gained. (21 refs.)

66164 Positronium ion in the modified adiabatic approximation. A.V.Filinskii.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.82-4 (Feb. 1983). In Russian.
Application of the adiabatic approximation to the positronium ion does not provide a bound state. A modified adiabatic approximation taking into account nonadiabatic effects was proposed by T.K. Rebane (1974). By this approach one can obtain the positive value of the binding energy quite easily. (8 refs.)

The observation on o-P_s annihilation in silica aerogel by combined spectrometer ....See Entry 68355

36.20 MACROMOLECULES AND POLYMER MOLECULES

(for biological macromolecules, see also 87.15; for polymer reactions and polymerization, see 82.35)

66165 Molecular electrostatic potential versus field. Significance for DNA and its constituents.. A.Pullman, B.Pullman, R.Lavery (Inst. de Biologie Phys. Chimique, Lab. de Biochimie Theorique, Paris, France).
THEOCHEM (Netherlands), vol.10, p.85-91 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The studies of the electrostatic properties of molecules and in particular of biomolecules and biopolymers have, until recently, been limited essentially to the exploration of their molecular electrostatic potential (MEP). The authors have extended these studies to the evaluation of the molecular electrostatic field (MEF). It is shown that the different dependence upon distance of these two related properties produces substantial differences in their spatial distribution, particularly prominent in the case of macromolecules, such as the nucleic acids. Thus, while the deepest potentials are found in the grooves of DNA, the highest fields are associated with its phosphate groups. This situation has important consequences for the exploration of the biochemical reactivity of these substances, MEP being particularly appropriate for the study of the interaction with ionic, electrophilic reactants and MEF for the study of the interaction with neutral dipolar species, prominent among which is water. (18 refs.)

66166 Anisotropic rotational diffusion of an α helix and analysis of the internal motion of side chains. H.Hanssum, H.Ruterjans (Inst. fur Biophys. Chem., Univ. Frankfurt, Frankfurt, Germany).
J. Chem. Phys. (USA), vol.78, no.7, p.4687-97 (1 April 1983).
In order to investigate the anisotropic rotational diffusion of the backbone and the side chains of poly-*L*-lysine the ^{13}C spin-lattice and spin-spin relaxation times of all carbon atoms with directly bound H atoms have been obtained at a Larmor frequency of 67.89 MHz. The polypeptide was dissolved in a mixed solvent of 40% methanol and 60% water. In this solvent, at *p*H=11.3, the backbone of poly-*L*-lysine is in the conformation of an α helix with partially charged side chains. The macromolecule was, therefore, regarded as a rigid rod and the rotational diffusion of the backbone was described by two diffusion constants D_1 and D_3 which characterize the rotational diffusion of, and around, the symmetry axis, respectively. The rotational motion of the C^{β} methylene group with respect to the laboratory coordinate system is characterized by the rotational diffusion of the backbone relative to the laboratory system and by superposed rotations around the C^{α}-C^{α} bond relative to the molecular coordinate system. Simulation of the possible internal motions by using a molecular model has shown that only two rotameric positions of the β methylene group are allowed. Consequently, the model of jumps between two allowed rotamers was applied in the evaluation procedure. The corresponding theory of spin-relaxation was evaluated using Wigner rotation matrices. The diffusion constants of $D_1=1.0\times10^5$ s^{-1}, $D_3=3.8\times10^7$ s^{-1}, and the jump rate of $k_1=5.0\times10^7$ s^{-1} were evaluated. The rotations of the $C^{\gamma}H_2$, $C^{\delta}H_2$, and $C^{\epsilon}H_2$ methylene groups have been described with the model of one-dimensional diffusion around the corresponding bonds. (58 refs.)

66167 The influence of protein dynamics on Mossbauer spectra. E.W.Knapp, S.F.Fischer, F.Parak (Dept. of Phys., Tech. Univ. Munchen, Garching, Germany).
J. Chem. Phys. (USA), vol.78, no.7, p.4701-11 (1 April 1983).
Protein dynamics gives rise to characteristic changes in a Mossbauer spectrum. The spectra are analyzed by a minimum of three Brownian oscillator modes accounting for protein specific motion probed by the Mossbauer nucleus. Two of these modes are extremely overdamped; a third mode has a diffusionlike character. The drastic changes of the Mossbauer spectrum with temperature are simulated by an extended version of the Brownian oscillator. With this oscillator the protein is characterized by conformational substates and transition states. The first are responsible for the solidlike, the latter for the liquidlike behavior of the protein. The interplay of transition states and conformational substates is responsible for largely different temperature dependences of the mean square displacements from X-ray and Mossbauer experiments. (42 refs.)

66168 On the ring-to-chain ratios of radii of gyration and sedimentation coefficients of polymers of the freely jointed model: Monte Carlo calculations and the ε method. Y.Chen (Nat. Inst. of Arthritis, Diabetes & Digestive & Kidney Diseases, Nat. Inst. of Health, Bethesda, MD, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5191-6 (15 April 1983).
The configurations of rigid polymers of the freely jointed model (with excluded-volume effect) are generated on a computer using an efficient ring-generation method recently developed by the author (1981). The ring-to-chain ratios of radii of gyration and sedimentation coefficients are calculated using the generated configurations of chains and rings for a number of polymer sizes. The limiting ratios at infinite molecular weight are obtained by extrapolation and compared with those obtained by the ε method of Bloomfield and Zimm (1966), Sharp and Bloomfield (1968) and Yu and Fujita

(Yamakawa, 1971). It is found that all three treatments do not agree with the Monte Carlo results. (22 refs.)

66169 Brownian dynamics simulation of systems with transitions, particularly conformational transitions in chain molecules. E.Helfand (Bell Labs., Murray Hill, NJ, USA).
Physica A (Netherlands), vol.118A, no.1-3, p.123-35 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
Computer simulations are an effective means of probing complex nonlinear phenomena and in particular transitions. Most real systems cannot be simulated in their entirety because of limitations on computer time and storage. One useful simplification is to replace some degrees of freedom by mean field, frictional, and stochastic terms acting on the remaining degrees of freedom. Numerical techniques for solving the resulting stochastic differential equations of motion have been advanced recently. A problem with simulations is to analyze the wealth of data generated. For the study of transitions, hazard analysis has proved to be effective. An example of the above program, which led to new insights, is the study of conformational transition mechanisms in chain molecules. A crank-like counterrotation of parallel, second-neighbor bonds has been shown to be an important feature of such transition processes. (9 refs.)

Heat capacity and other thermodynamic properties of linear macromolecules. VI. Acrylic polymers .... See Entry 64601

Potts model formulation of branched polymers in a solvent ..... See Entry 64841

Sensitivity of V_2' saturation transfer electron paramagnetic resonance signals to anisotropic rotational diffusion with [^{15}N] nitroxide spin-labels. Effects of noncoincident magnetic and diffusion tensor principal axes .... See Entry 64925

Possibility of the investigation of conformational changes in protein molecules with fluorescent probes in the picosecond time range .... See Entry 66062

Spectral-kinetic properties of the delayed fluorescence of complex molecules with inhomogeneously broadened energy levels .... See Entry 66063

Linear dichroism studies of flavins in stretched poly(vinyl alcohol) films. Molecular orientation and electronic transition moment directions .. See Entry 66069

Analysis of the Rouse model in extensional flow. I. A general solution of the distribution function in an arbitrary flow field .... See Entry 66539

Analysis of the Rouse model in extensional flow. II. Stresses generated in sink flow by flexible macromolecules and by finitely extended macromolecules .... See Entry 66540

Wide-line NMR in polymers .... See Entry 68049

The electronic structure of polyphenyls and poly(p-phenylene) .... See Entry 68399

Changes of certain properties of applied and nonapplied matrices of zirconium hydroxide in the course of ageing .... See Entry 68805

Structure of the influenza virus glycoprotein antigen neuraminidase at 2.9 Å resolution .... See Entry 68922

Structure of the catalytic and antigenic sites in influenza virus neuraminidase .... See Entry 68923

Structure of trimeric haemerythrin .... See Entry 68924

36.40 ATOMIC AND MOLECULAR CLUSTERS

66170 Magic numbers for argon and nitrogen cluster ions. L.Friedman, R.J.Beuhler (Dept. of Chem., Brookhaven Nat. Lab., Upton, NY, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4669-75 (1 April 1983).
Evidence for the existence of magic numbers for cluster ions of argon atoms and nitrogen molecules has been found with high molecular weight mass spectra of their cluster ions. The observed numbers of 145, 303, 550, and 912 in mass spectra of cluster ions coincides within experimental error limit with the number of particles required for complete shell icosahedra. Failure to observe similar magic number structures in mass spectra of polyatomic molecule cluster ions and differences between polyatomic molecule cluster ion mass spectra and the argon and nitrogen cluster ion spectra are discussed. (13 refs.)

66171 Noncrystalline structure of argon clusters. I. Polyicosahedral structure of Ar_N clusters, $20<N<50$. J.Farges, M.F.de Feraudy, B.Raoult, G.Torchet (Lab. de Phys. des Solides, Univ. de Paris Sud, Orsay, France).
J. Chem. Phys. (USA), vol.78, no.8, p.5067-80 (15 April 1983).
Small argon clusters are produced in a free jet expansion and studied by electron diffraction. Due to their very low proportion in the beam sample in comparison to the monomers, the smallest detectable clusters contain about 20 atoms. When they grow up to some 50 atoms, they present the same noncrystalline structure. This structure is identical to that of solid models constructed during a molecular dynamics calculation by cooling a liquid drop of atoms interacting through a Lennard-Jones potential. Because it is composed of icosahedra of 13 atoms, either joined one to the other either interpenetrating each other, this structure may be called polyicosahedral. The comparison between theoretical and experimental diffraction functions leads to an estimate of the cluster temperature 27±3K and of the proportion of monomers in the beam. The authors discuss the similarity in the radial distribution functions of both PIC models and bulk amorphous materials, and give arguments for the stability of the clusters. (18 refs.)

66172 Electronic structure of H_n^+ and HeH_n^+ clusters. S.Raynor, D.R.Hereschbach (Dept. of Chem., Harvard Univ., Cambridge, MA, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.289-93 (20 Jan. 1983).
The 'solvation' of a H_3^+ molecule-ion by H_2 molecule(s) and/or a He atom was examined in ab initio electronic structure calculations. Binding energies and geometrical parameters were determined for the ground electronic states of H_n^+ (n=3,5,7,9,11) and HeH_n^+ (n=3,5,7,9) cluster ions. Floating spherical Slater orbitals (FSSO) were employed with full single and double configuration interaction (CI). All of the clusters studied were found to be weakly bound (with respect to removal of 'solvent' species). Inclusion of configuration interaction had a mjaor effect; for $n\geq5$, it increased the energy required to remove an H_2 molecule from H_n^+ by ~35% and that to remove the He atom from HeH_n^+ by ~300-400%. (20 refs.)

Chemical bonding in transition metal magnetic molecules and clusters .... See Entry 66152

Molybdenum chalcogenides: clusters, chains, and extended solids. The approach to bonding in three dimensions .... See Entry 67501

40.00 CLASSICAL AREAS OF PHENOMENOLOGY

(inc. applications)

41.00 ELECTRICITY AND MAGNETISM; FIELDS AND CHARGED PARTICLES

(see also 03.50 Maxwell theory: general mathematical aspects)

41.10 CLASSICAL ELECTROMAGNETISM

66173 Mechanical forces acting on capacitor electrodes in the presence of dielectric. K.M.Polivanov.
Elektrichestvo (USSR), no.1, p.1-6 (Jan. 1982). In Russian.
Analysis and examples show that in the presence of polarised dielectrics two augends of ponderomotive forces can always exist (disregarding strictive forces). One is determined by interaction between free charges and the field strength depending on the position of the dielectric and its properties. The other is determined by the pressure exerted by the dielectric on the body in contact with it. The selection of Maxwell tensor representations is discussed. (7 refs.)

66174 On the admissible values of the static magnetic permeability. O.V.Dolgov, D.A.Kirzhnits, V.V.Losyakov (Phys. P.N. Lebedev Inst., Moscow, USSR).
Solid State Commun. (USA), vol.46, no.2, p.147-9 (April 1983).
A systematic analysis of causal properties (dispersion relations) and stability under electrodynamic excitations on isotropic and uniform media is carried out. From here the range of admissible values of the static magnetic permeability is determined. It is shown that the appearance of a diamagnetic spontaneous current is impossible and there is no medium with a negative magnetic permeability. (6 refs.)

41.10D Electrostatics, magnetostatics

66175 Maximum effective charge and confinement radius for the Coulomb condensate for an isolated, charged sphere or cylinder in an electrolyte. M.A.Lampert (Dept. of Electrical Engng. & Computer Sci., Princeton Univ., Princeton, NJ, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.475-8 (15 April 1983).
An absolute upper bound theorem for the Poisson-Boltzmann equation is used to calculate, for an isolated, charged sphere or cylinder in an electrolyte (i) the maximum effective charge which can be seen afar, and (ii) a radius within which the Coulomb condensate, if present, is confined. (6 refs.)

66176 Equilibrium of magnetic liquids, magnetostatic application. J.P.Brancher, O.Sero Guillaume (LEMTA, Nancy, France).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.265-83 (1983). In French.
Magnetic liquids can be shaped by externally applied, constant magnetic fields. The study of stable equilibria is carried out using a variational principle which leads to local conditions on the free boundary. The results are applied to liquid metals submitted to high frequency magnetic fields. (14 refs.)

66177 Hydrodynamic model of the static phenomena of electromagnetism. R.G.Barrera (Inst. de Fisica, Univ. Nacional Autonoma de Mexico, Mexico City, Mexico).
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.267-88 (Feb. 1983).
The authors present a hydrodynamical model which correctly describes the whole phenomenology of electrostatics and magnetostatics. Their purpose is to offer a parallel explanation to the usual one based on actions 'at a distance' in order to show the importance of the ideas about the internal mechanisms which rule the physical phenomena in the development of scientific activity. (21 refs.)

66178 A method for the computation of the linearized scalar potential for the magnetostatic field problems. J.H.Bramble, J.E.Pasciak (Dept. of Math., Cornell Univ., Ithaca, NY, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.32-5, vol.5
Reformulates the linearized scalar potential problem in terms of solution operators of standard elliptic boundary value problems on bounded domains with the introduction of spherical harmonics to handle the condition at infinity. The problem is then discretized by replacing these operators with their Galerkin-finite element counterparts and taking finite subspaces of spherical harmonics. The errors and computational properties are discussed. (11 refs.)

66179 Field computation using finite element method. K.M.Shebl, S.A.Farghal, Y.Abed (Mansoura Univ., Mansoura, Egypt).
Seventeenth Universities Power Engineering Conference, Manchester, England, 30 March-1 April 1982 (Manchester, England: Univ. Manchester Inst. Sci. Technol. 1982), 6 pp.
Presents a comprehensive analysis for the electric field intensity and potential distribution in the surrounding space of the axisymmetrical needle-plane electrode, with its strongly divergent electric field. The field near the tip of the needle is investigated thoroughly in terms of needle radius, number of subdivided elements and different boundary conditions. The effect of the needle height on the electric field intensity is discussed. (4 refs.)

Investigations of a two-dimensional integral equation in the theory of elasticity and electrostatics .... See Entry 64683

Physical behaviour of a magnetic one-component developer ..... See Entry 64972

Model of one-component magnetic brush development .... See Entry 64973

Spacecraft charging effects .... See Entry 69477

41.10F Steady-state electromagnetic fields; electromagnetic induction

66180 Electromagnetic fields in a conducting spheroidal cavity: new integral equations allowing a simplified numerical solution. J.A.Imbeau (Dept. des Sci. Pures, Univ. du Quebec a Chicoutimi, Chicoutimi, Quebec, Canada), B.T.Darling, P.Amiot.
Can. J. Phys. (Canada), vol.61, no.4, p.571-81 (April 1983).
New integral equations (Darling and Imbeau (1980), Imbeau and Darling (1979)) from a generalized Huygens principle allow the calculation of electro-

magnetic fields and resonance frequencies in a conducting spheroidal cavity excited by an elementary Hertz dipole in the cavity. These equations separate into surface integral equations for the fields observed inside the cavity and null surface integral equations. The latter have a regular kernel and this permits the calculation of all the fields on the surface. The ensuing simplification allows an easy calculation of the resonance frequencies with the precision of all 16 significant digits available on an IBM-370 working in double precision. (7 refs.)

66181 Calculation of magnetic eddy fields by the scalar magnetic potential. K.S.Demirchyan, V.L.Chechurin.
Elektrichestvo (USSR), no.1, p.7-14 (Jan. 1982). In Russian.
Expounds a method for calculating magnetic fields on the basis of eddy field 'reduction' to potential fields of magnetic charges. Straight conductors of various cross-sectional shapes and coils creating three-dimensional fields are modelled. Considers introduction of fictitious currents and charges to minimise the space occupied by potential field sources. The method is applicable for calculation of the field in piecewise-uniform and nonlinear media. A quasi-stationary eletromagnetic field is calculated by the scalar magnetic potential. (18 refs.)

66182 Charge distributions in rotating conductors. O.Gron, K.Voyenli (Inst. of Phys., Univ. of Oslo, Oslo, Norway).
Eur. J. Phys. (GB), vol.3, no.4, p.210-14 (1982).
The charge distribution and electromagnetic field in a rotating conductor with a net electric charge under stationary conditions are described by Maxwell's equations and the Lorentz' force equation. The equations are written both in the inertial rest frame of the rotational axis and in the rotating rest frame of the conductor. They are applied to the case of a rotating cylinder. The existence of a spatial charge distribution in a rotating conductor is demonstrated. (42 refs.)

66183 Use of a perfectly conducting sphere to excite the plasmon of a flat surface. I. Calculation of the local field with applications to surface-enhanced spectroscopy. P.K.Aravind, H.Metlu (Dept. of Chem. Univ. of California, Santa Barbara, CA, USA).
J. Phys. Chem. (USA), vol.86, no.26, p.5076-84 (23 Dec. 1982).
The authors study the electromagnetic properties of a system consisting of a perfectly conducting sphere and a dielectric half-sphere driven by a laser. They show that the local field in the space between the sphere and the plane is strongly enhanced, making the system an interesting candidate for surface-enhanced spectroscopy. The dependence of the local field on the frequency and the spatial distribution of the enhancement factor are presented. Possible applications are discussed. (20 refs.)

66184 Energy characteristics of an electromagnetic wave and an external particle in a dispersive medium. V.P.Oleinik.
Kvantovaya Elektron., Kiev (USSR), no.23, p.80-90 (1982). In Russian.
Classical Hamiltonian mechanics is employed to examine the energy characteristics of an electromagnetic field in a transparent dispersive medium. An equation for the balance of energy in the electromagnetic field and in the external particle is obtained together with an expression for the energy of the field and a formula for the Hamiltonian function of interaction of an external particle with the electromagnetic field in the medium. The surface models of the electromagnetic fields are calculated. (11 refs.)

66185 The coherent electromagnetic field in a stochastic dielectric. D.S.Bugnolo (Florida Inst. of Technol., Melbourne, FL, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.504-6
The results of the Wigner tensor formulation for the coherent component of the electromagnetic field in an isotropic, time-invariant stochastic dielectric, are compared to some previously published results obtained by the parabolic approximation. This is done by way of a first approximation for the diagonal component of the Wigner tensor, valid for the case of weak fluctuations of the medium. (5 refs.)

Magnetic field analysis for electron beam deflector using a boundary integral method .... See Entry 66198

Theory of an almost toroidal dynamo .... See Entry 66637

Compensation of induced magnetic fields at high magnetic Reynolds number .... See Entry 66643

Analytical method of solving one class of nonlinear problems in electromagnetic inspection of ferromagnetic products .... See Entry 68742

Experimental investigation of effective magnetic fields in a magnetic fluid .... See Entry 68811

41.10H Electromagnetic waves: theory

66186 Radiation pressure and 360° scattering diagrams for infinite cylinders. A.Cohen (Dept. of Atmospheric Sci., Hebrew Univ. of Jerusalem, Jerusalem, Israel), A.Gross.
Opt. Lett. (USA), vol.8, no.5, p.253-5 (May 1983).
The general solution for the scattering of electromagnetic radiation by a tilted infinite dielectric cylinder is discussed. Angular scattering curves of 360° for two polarizations are presented for given values of the size parameter and the incident polarization angle. The radiation pressure on tilted cylinders for arbitrary polarization is calculated and shown not necessarily to be within the incident plane. (5 refs.)

66187 Polarization effects in the diffraction of electromagnetic waves: the role of disclinations. J.F.Nye (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.105-32 (8 May 1983).
Three-dimensional diffraction patterns of monochromatic electromagnetic waves contain moving line singularities where the magnitude of the transverse field is zero, and its direction is therefore indeterminate. They are called disclinations, by analogy with the corresponding linear features in liquid crystals. A disclination in a vector wave is a natural generalization of a dislocation in a scalar wave. Where the scalar wave approximation in optics predicts a dislocation, or interference null, the full vector theory reveals a double helix structure: a disclination line in the electric field and another in the magnetic field winding around each other with a spacing of order (wavelength/2π). A perturbing plane wave causes this composite structure itself to become coiled. When there is a 'polarization effect' in the diffraction pattern a disclination in the electric field becomes a moving helix or, more generally, a coiled coil. As it moves it sweeps out a surface on which the polarization is everywhere linear. In optical experiments this observable surface is the most significant effect of disclinations. In general, however, the disclinations constitute elements of structure of the electromagnetic field, and their arrangement thus provides an effective way of describing the three-dimensional geometry of even very complicated diffraction fields, for example of microwaves. (15 refs.)

66188 The rate of random variability in the method of total correlation analysis. G.I.Khudykov.
Radio Eng. & Electron. Phys. (USA), vol.27, no.6, p.72 (June 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.6, p.1138-43 (June 1982). [received: May 1983]
Summary form only given, as follows. The general form of the space-time correlation functions of random wave fields is considered. A relationship between the phase velocities of the waves propagating in a given medium and the velocity of the chaotic variability, which is obtained during the statistical processing of the results of the radio-physical probing of the medium by the method of total correlation analysis, is established. (no refs.)

66189 Natural waves in an azimuthally magnetized bigyrotropic medium. III. V.A.Meshcheryakov, A.E.Mudrov, G.A.Red'kin (V.A. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.628-31 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.52-6 (July 1982). [received: May 1983]
For pt.II see Sov. Phys. J. (USA), vol.22, no.9, p.969-73 (1979) or see Izu. VUZ. Fiz. (USSR), vol.22, no.9, p.54-9 (1979). An asymptotic solution has been obtained for the system of generalized wave functions of an electromagnetic field in an azimuthally bigyrotropic medium in the proximity of an irregular singular point. The characteristic values and exponents have been determined and recurrence formulas have been established for the coefficients of formal series and the solutions found are presented in terms of the partial sums of the decreasing terms of the series. The authors consider the passages to the limit of characteristic particular cases. The results are given of a comparison of the calculation of one asymptotic solution and the corresponding regular solution. Together with the regular solutions, the relations established enable model investigations to be carried out on wave processes in media and oscillatory systems with an azimuthal double gyrotropy over a wide range of their parameters. (4 refs.)

Energy characteristics of an electromagnetic wave and an external particle in a dispersive medium .... See Entry 66184

41.70 PARTICLES IN ELECTROMAGNETIC FIELDS: CLASSICAL ASPECTS

(inc. synchrotron radiation)

66190 Singularities of angular spectral characteristics of the radiation of an electron moving along the arc of a circle. V.G.Bagrov, G.K.Razina, N.N.Sirota, N.I.Fedosov (Inst. of High-Current Electronics, Acad. of Sci., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.648-51 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.72-6 (July 1982). [received: May 1983]
A detailed analysis is given of the angular distribution of low-frequency domain of the radiation spectrum of an electron moving over a circular arc. (7 refs.)

66191 Interaction of a helical nonsymmetric wave with a fast cyclotron wave in an electron beam. D.V.Gorozhanin, B.I.Ivanov, M.I.Kapchinskii.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1339-42 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2177-82 (Nov. 1982). [received: May 1983]
The interaction of nonsymmetric waves ($m=\pm 1$) in a helical resonator with fast cyclotron waves in an electron beam is studied experimentally and theoretically. A theoretical explanation is given for the observed dependence of the interaction of the magnetic field orientation in terms of the beam gyration in the magnetic field and the azimuthal anisotropy of the resonator. As the beam velocity is increased, the locations of the cyclotron resonances change in accordance with the Doppler equation; the upper resonant frequency ($\Omega=\omega+k_2 G\nu$) becomes smaller in absolute value than the lower frequency $\Omega=\omega-k_2\nu$, where Ω is the cyclotron frequency, Ω and k_z are the frequency and wave number, and ν is the beam velocity. (19 refs.)

Polarization precession in quadrupoles and sextupoles .... See Entry 65745

Axially symmetric electrostatic and magnetic fields for ion beam focusing .... See Entry 65786

Energy characteristics of an electromagnetic wave and an external particle in a dispersive medium .... See Entry 66184

Free-electron lasers and their applications .... See Entry 66287

Highly nonlinear theory of the free electron (Compton) laser. Exact equations .... See Entry 66289

Highly nonlinear theory of the free-electron (Compton) laser. Average equations .... See Entry 66290

Parametric interaction and backward wave oscillation in stimulated Compton scattering .... See Entry 66331

41.80 PARTICLE BEAMS AND PARTICLE OPTICS

(see also 07.80 Electron and ion microscopy, 07.77 Beam handling equipment)

66192 Thermal axially symmetric charged-particle beams in the paraxial region. A.Svoboda (Faculty of Maths. & Phys., Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.401-28 (1983).
An elementary solution of the Vlasov kinetic equation is found (in the paraxial approximation), the use of which enables the author to construct the distribution function of a charged-particle beam generated by an arbitrary source. This method is applied to a thermal electron beam originating from a planar cathode with a Maxwellian emission, generalized relations for the axial component of current density are given (by including the whole phase space), and it is shown that they include as special cases the well-known current density limits investigated by Pierce (1939) and Ash (1964). The pressure tensor of the thermal electron beam is expressed explicitly, by the use of which the transversal and axial effective temperatures at any point of the paraxial region are introduced. The distribution function of a given electron beam behind an aperture is found and the behaviour of the axial component of current density in this region is investigated. It is demonstrated that the author's theory is valid for beams the perveances of which fulfil the inequality $P\ll 6.6\times 10^{-5}$ A/V$^{3/2}$. (20 refs.)

66193 Beam evolution in the field of unipotential lenses. S.Marghitu, C.Oproiu (Inst. Central de Fizica, IFTAR, Bucuresti, Rumania), R.Crametiuc.
Stud. & Cercet. Fiz. (Rumania), vol.34, no.10, p.972-81 (1982). In Rumanian.
A method for computer calculation of particle trajectory in electrostatic lenses with rotational symmetry is presented. This method was applied in the analysis of several three-electrode 'einzel' lenses susceptible to be utilized in direct accelerators. Evolution of a beam of known emittance through a particular lens geometry is also presented; the computer calculation uses as initial condition a number of points on the phase contour in object space. (7 refs.)

On relations among objects, images and beam waists for charged particle beams .... See Entry 65807

41.80D Electron beams and electron optics

66194 A generalized formula of the third order electrical deflection aberration coefficients and their relation with the raster pattern. Ding Shou-Qian (Dept. of Phys., Nankai Univ., China).
Acta Phys. Sin. (China), vol.32, no.2, p.145-55 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
This paper deals with the generalization of the theory of third order aberrations of an electrical deflection system under the situation as the electron beam is originally immersed in an electric field. The formulae of third order electrical deflection aberration coefficients in an arbitrary plane have been derived. It can be applied to either sequential deflection systems or superimposed deflection yokes. By means of mathematical manoeuvres, the formulae are simplified and made easy for calculation. In order to obtain high precision, the first and second order derivatives of the field $E_0(z)$ have been eliminated. (10 refs.)

66195 Spin polarized electrons. H.C.Siegmann (Lab. fur Festkorperphys., ETH, Zurich, Switzerland).
Europhys. News (Switzerland), vol.14, no.2, p.9-12 (Feb. 1983).
Discusses methods of producing and measuring a spin-polarized electron beam. (7 refs.)

66196 A contribution to the study of electron diffraction fringes at the edge of a screen using energy filtering and field emission. M.Denizart, B.Jouffrey, S.Roques, F.Sonier, J.Trinquier (Lab. d'Optique Electronique du CNRS, Toulouse, France).
C.R. Seances Acad. Sci. Ser. II (France), vol.296, no.5, p.329-31 (7 Feb. 1983). In French.
In energy-filtered defocused images, a bright fringe has been observed on each side of the edge of a screen. (15 refs.)

66197 Mathematical modeling of the relaxation of a powerful electron beam in a strong sinusoidal magnetic field, taking radiation into account. B.V.Alekseev, V.M.Krutilina, A.S.Litvinovich, G.V.Nesterov (S. Ordzhonikidze Moscow Aviation Inst., Moscow, USSR).
High Temp. (USA), vol.20, no.4, p.501-5 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.609-13 (July-Aug. 1982). [received: April 1983]
Numerical calculations are made of the relaxation of a powerful (0.6 MW) electron beam in air, in a strong solenoidal magnetic field. A combined code is developed, including the Monte Carlo method for calculating the evolution of the beam, the method of characteristics for calculating the divergence of the radiant flux, and the Pismen-Rockford method for calculating the air temperature. The configuration and region of beam relaxation, the heat liberation, the bremsstrahlung intensity, the electron concentration in the beam, and the temperature field of the medium are obtained. (10 refs.)

66198 Magnetic field analysis for electron beam deflector using a boundary integral method. K.Kuroda (Central Res. Lab., Hitachi Ltd., Tokyo, Japan).
Optik (Germany), vol.64, no.2, p.125-31 (May 1983).
Describes a method for analyzing 3-dimensional magnetic fields for electron deflectors. In the basic formulation, the normal component flux density on the magnetic material surfaces is given in terms of unknown values. Computations were carried out for magnetic materials combined with cosine-distributed coils that were formed in rotationally symmetrical shapes. With this particular combination, inherent 3-dimensional problems can be reduced to 1-dimensional ones. Computation was possible with only 1×10^{-2} to 1×10^{-3} errors, within 8 to 95 seconds, and by employing a memory size of 256 kBytes. This method will be particularly useful for problems of such symmetry, especially for those with open boundaries. (9 refs.)

66199 On the solution of integral equations arising in electron optical field computations. E.Kasper (Lehrstuhl fur Theoretische Elektronenphys., Univ. Tubingen, Tubingen, Germany).
Optik (Germany), vol.64, no.2, p.157-69 (May 1983).
A simple and very accurate algorithm is developed for the iterative numerical solution of one-dimensional integral equations of Fredholm's type. Such equations are often to be solved in electron optical boundary value problems. The integrand is no longer treated as a piecewise constant function but is approximated by a smooth quadratic spline function. Further a simple summation formula is developed for the integration over logarithmic singularities. With only moderate demand for memory the relative computation error is 10^{-5} or less. (17 refs.)

66200 Dispersion properties and aberration coefficients of electrostatic cylindrical mirrors. V.M.Kel'man, S.P.Karetskaya, N.Yu.Saichenko, L.F.Fedulina (Inst. of Nuclear Phys., Acad. of Sci., Alma-Ata, Kazakh SSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1318-21 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2140-5 (Nov. 1982). [received: May 1983]
The electron-optical parameters of two- and three-electrode electrostatic cylindrical mirrors are calculated for electrodes having the form of parallel plates. Conditions are determined under which the mirrors produce a sigmatic image. It is shown that the dispersion under these conditions is considerable and that the aberration in three-electrode systems may be very small, so that such systems are particularly well suited for use as energy analyzers. (13 refs.)

66201 Electrostatic charged particle analyzer with three coaxial cylindrical electrodes. III. A three-stage analyzer with general ring-ring focusing. K.A.Men'shikov ('Quantum' Sci. & Industrial Union, Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1379-83 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2245-52 (Nov. 1982). [received: May 1983]
For pt.II see ibid., vol.27, no.10, p.1268-71 (1982). The properties of a three-cylinder mirror analyzer are described for the general case when the electron-optical source and image are rings coaxial with the cylinders. It is shown that the three-cylinder mirror analyzer gives fourth-order focusing, and that if only third-order focusing is required the input angle of the principal beam trajectory may be chosen almost arbitrarily. In the second-order focusing mode, the focal length (which is determined solely by the electrode potentials) can be varied. (9 refs.)

Interaction of a helical nonsymmetric wave with a fast cyclotron wave in an electron beam .... See Entry 66191

Thermal axially symmetric charged-particle beams in the paraxial region .... See Entry 66192

41.80G Ion beams and ion optics

Compensation of aberrations in achromatic quadrupole doublets .... See Entry 65785

Axially symmetric electrostatic and magnetic fields for ion beam focusing .... See Entry 65786

42.00 OPTICS

(for properties of gases and of liquids and solids, see 51.70 and 78. respectively; for atmospheric optics, see 92.65; for physiology of the eye, see 87.32)

42.10 PROPAGATION AND TRANSMISSION IN HOMOGENEOUS MEDIA

66202 Gaussian beam ray-equivalent modeling and optical design. R.Herloski, S.Marshall, R.Antos (Joseph C. Wilson Center for Technol., Xerox Corp., Webster, NY, USA).
Appl. Opt. (USA), vol.22, no.8, p.116-74 (15 April 1983).
It is shown that the propagation and transformation of a simply astigmatic Gaussian beam by an optical system with a characteristic ABCD matrix can be modeled by relatively simple equations whose terms consist solely of the heights and slopes of two paraxial rays. These equations are derived from the ABCD law of Gaussian beam transformation. They can be used in conjunction with a conventional automatic optical design program to design and optimize Gaussian beam optical systems. Several design examples are given using the CODE-V optical design package. (15 refs.)

66203 Diffraction analysis of rotationally symmetric optical systems using computer-generated aberration polynomials. S.C.Tam, G.D.W.Lewis, S.Doric, D.Heshmaty-Manesh (Blackett Lab., Imperial Coll., London, England).
Appl. Opt. (USA), vol.22, no.8, p.1181-7 (15 April 1983).
A ray trace scheme for the automatic generation of optical aberration polynomials to arbitrary orders pioneered by T.B. Andersen is successfully applied to the diffraction analysis of rotationally symmetric optical systems on a desktop computer. The diffraction-based optical transfer functions at various field positions are computed using the relatively new Winograd Fourier transform algorithm. The coding includes aspherical and reflective surfaces. (17 refs.)

66204 Calculation of refractive indices using Buchdahl's chromatic coordinate. P.N.Robb, R.I.Mercado (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
Appl. Opt. (USA), vol.22, no.8, p.1198-215 (15 April 1983).
In this paper the authors have completed an error analysis of the Buchdahl glass model for 813 glasses available from five manufacturers. A quadratic model has a standard deviation of 0.00002 and a maximum absolute error of 0.0001 in the visible spectral region. A cubic model has a standard deviation of 0.00005 and a maximum absolute error of 0.00026 over the full spectral region from 0.365 to 1.014 μm. A table giving the Buchdahl fitting coefficients for all the glasses, as well as the standard deviation and maximum error for each glass, is included for the quadratic model. The results indicate that the Buchdahl model is ideally suited for theoretical studies of refracting optical systems. (11 refs.)

66205 Gaussian brackets and their application to paraxial theory. II. Paraxial theory in terms of generalized Gaussian constants. K.Tanaka (Canon Res. Center, Canon Inc., Tokyo, Japan).
Optik (Germany), vol.64, no.2, p.89-111 (May 1983).
For pt.I see ibid., vol.64, pt.1, p.13 (1983). Reconstructs the formulation of paraxial theory in terms of Gaussian brackets together with some novel formulae, and presents some examples of application to analyses of optical systems. (25 refs.)

66206 Diffraction of light by a perfectly conducting biaxial periodic surface. A.Wirgin (Lab. de Mecanique Theorique, Univ. Paris VI, Paris, France).
Opt. Commun. (Netherlands), vol.45, no.4, p.221-5 (15 April 1983).
The Rayleigh theory is numerically implemented for a crossed sinusoidal grating. It is shown that the scattering pattern of such a structure can be very sensitive to the polarization of a normally-incident plane wave when the surface periodicities are of the order of the wavelength. (26 refs.)

66207 Periodic spatial coherence function resulting from acoustooptic interaction in the Bragg diffraction region. Y.Ohtsuka, Y.Imai (Dept. of Engng. Sci., Hokkaido Univ., Hokkaido, Japan).
Opt. Commun. (Netherlands), vol.45, no.4, p.226-30 (15 April 1983).
A tentative description is given of the scheme for generating a periodic coherence function that results from the acoustooptic interaction in the optical Bragg diffraction region. The resultant coherence function varies with a period of one acoustic wavelength, as well as periodically with an increase in the acoustic power level. Its modulus and phase are computed and discussed. (13 refs.)

66208 Diffraction theory of the defocused-diaphram method. T.P.Kosoburd, F.A.Markus.
Opt. & Spectrosc. (USA), vol.53, no.3, p.330-2 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.559-61 (Sept. 1982). [received: May 1983]
The authors examine the intensity distribution in the observation plane of a schlieren instrument with a periodic structure as a defocused diaphragm, taking diffraction effects at the diaphragm into account and ignoring refraction in the object. (3 refs.)

66209 Young's interference fringes with narrow-band light. E.Wolf (Schlumberger-Doll Res., Ridgefield, CT, USA).
Opt. Lett. (USA), vol.8, no.5, p.250-2 (May 1983).
The changes in the interference pattern in Young's interference experiment, produced by placing two identical narrow-band filters in front of the pinholes, are analyzed. It is shown theoretically that, in general, the fringes will not become sharp (i.e. their maximum visibility will not tend to unity) even when the filters have arbitrarily narrow passbands. The analysis brings out a rela-

tionship between the complex degree of coherence in the space-time and the space-frequency domains. When the passbands of the filters are narrow enough, the filtered light is found to be cross-spectrally pure. (6 refs.)

66210 Light scattering efficiency of dielectric spheres. C.Singh, R.N.Singh (Phys. Dept., Indian Inst. of Technol., New Delhi, India).
Opt. Appl. (Poland), vol.12, no.2, p.219-29 (1982).
A theoretical study of individual and collective contributions of electric and magnetic multipoles to light scattering efficiency of dielectric spheres is presented. (5 refs.)

66211 Diffraction of light by a bigrating: Surface polariton resonances and electric field enhancements. N.E.Glass, A.A.Maradudin (Dept. of Phys., Univ. of California, Irvine, CA, USA), V.Celli.
Phys. Rev. B (USA), vol.27, no.8, p.5150-3 (15 April 1983).
The authors present a theory of the diffraction of light of arbitrary polarization incident on a doubly periodic dielectric grating. They use Rayleigh's method together with the vectorial equivalent of Kirchoff's integral. The amplitudes of the diffracted spectral orders are calculated for a sinusoidal bigrating and for a square lattice of hemiellipsoids on a flat surface, for Ag. The enhancement of the electric field on and near the surface is calculated and is found to reach values of about 300. (16 refs.)

66212 Significance of the caustic curves in optics. O.C.Nunez, J.P.Contreras, A.Rodriguez (Inst. Nacional de Astrofisica, Optica y Electronica, Puebla, Mexico), A.C.Davila.
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.245-58 (Feb. 1983).
The concept and a simplified formulation of the so-called caustic curves are introduced. It is assumed that the caustic curve is produced by a conic wavefront coming from an optical system or component. (9 refs.)

66213 Light refraction by an excited isotropic dispersing medium. B.A.Veklenko (Moscow Energy Inst., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.746-8 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.74-8 (Aug. 1982). [received: April 1983]
It is shown that a photon incident from a vacuum on a dispersing transparent isotropic medium undergoes double refraction if part of the molecules of the medium are in an excited state. The intensities of the refracted rays are estimated. (4 refs.)

66214 Calculation of ray paths in the principal plane of a uniaxial crystal. M.G.Serbulenko.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.487-9 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.18-19 (Aug. 1982). [received: April 1983]
An algorithm for calculating the ray paths in the principal plane of a uniaxial crystal having plane nonparallel boundaries is formulated on the basis of the principle of the conservation of the tangential components of the wave normals and the methods of analytical geometry. For the most part the algorithm does not employ trigonometric functions; this speeds up the calculation on a computer and increases its accuracy. (5 refs.)

66215 Diffraction of Gaussian beam by a smooth convex object. M.I.Yavor.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.84-8 (Feb. 1983). In Russian.
The asymptotics of the field of a Gaussian beam diffracted by a smooth convex object in a two-dimensional inhomogeneous medium has been obtained. It is assumed that the central ray of the Gaussian beam passes close to the object boundary, touches it or is reflected at the angle close to $\pi/2$. (7 refs.)

Generalized Fermat principle .... See Entry 64615

Three-dimensional interference-diffraction patterns .... See Entry 64626

Moire quasi-interferometry .... See Entry 64947

Diffraction images of two dimensional elliptical objects .... See Entry 66230

Diffraction of a light wave by a volumetric hologram in an anisotropic medium .... See Entry 66236

Holography, coherent light amplification and optical phase conjugation with photorefractive materials .... See Entry 66240

Laser fluctuation studies in intensity dependent absorption of light .... See Entry 66312

Future lenses for 16-mm cinematograph projectors .... See Entry 66362

Discussion of the relative efficiency in the vacuum ultraviolet of diffraction gratings with laminar, sinusoidal, and triangular grooves .... See Entry 66377

Phenomena of the transformation of light polarization in multimode lightguides .... See Entry 66385

Elastooptic effect in a bent slab waveguide .... See Entry 66389

Dispersion of tubular modes propagating in multimode optical fibres .... See Entry 66397

Influence of the fibre diameter on the stress birefringence in high-birefringence fibres .... See Entry 66400

Interferometric countercheck in precision cementing .... See Entry 66412

A possible mechanism of light absorption .... See Entry 68176

Edge effects in composites by moire interferometry .... See Entry 68703

42.20 PROPAGATION AND TRANSMISSION IN INHOMOGENEOUS MEDIA

66216 The statistical properties of polarized laser speckle. Wang Naiquan, Zhang Hong-jun, E.Yun (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.1, p.124-32 (Jan. 1983). In Chinese. English translation in; *Chin. J. Phys. (USA)*
The statistical properties of polarized laser speckle is discussed. An exact probability density function is integrated intensity of partially polarized laser speckle is obtained. The authors study by the experiment how the probability density function of integrated intensity of polarized laser speckle varies with the area of detector aperture and mean intensity. (8 refs.)

66217 The mean square error of the multiplicative model for speckle noise. Qin Ke-Cheng (Dept. of Phys., Peking Univ., Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.267-72 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The mean square error of the multiplicative model for speckle noise in coherent imaging is derived. The author obtains the condition under which the multiplicative model is valid, that is: the model only when the details of the object can be completely resolved by the imaging system. (9 refs.)

66218 Light scattering by large spheroids in the Physical Optics Approximation: numerical comparison with other approximate and exact results. J.C.Ravey, P.Mazeron (Lab. de Biophys. Moleculaire, Univ. de Nancy I, Vandoeuvre Les Nancy, France).
J. Opt. (France), vol.14, no.1, p.29-41 (Jan.-Feb. 1983).
Physical Optics Approximation is used to compute scattering efficiency factors forward- and back-scattering intensities, angular distributions of intensity and depolarization by large dielectric or absorbing spheroids. The results are compared with those obtained by exact theories or other approximate calculations. If the radius of curvature at any point of the illuminated part of the scatterer is greater than about a few wavelengths, that approximation is generally the best one and in good agreement with the exact theories. This curvature requirement depends on the size of the spheroid but also on its orientation with respect to the incident light direction. (21 refs.)

66219 On further development of the layer decomposition method applied to wave propagation in inhomogeneous media. P.Croce (Inst. d'Optique, Centre Univ. d'Orsay, Orsay, France).
J. Opt. (France), vol.14, no.1, p.49-55 (Jan.-Feb. 1983). In French.
The basic equation yielding the radiance scattered from a plane layer, as formulated in previous papers, is determined again by using changes in the tangential components of both electric and magnetic fields. Hence it is possible to extend the layer decomposition method to wave propagation in inhomogeneous media having a rough cylindrical or spherical symmetry. For a very simple case a programme has been written to test practical potentialities of the method. (5 refs.)

66220 Non-Gaussian image plane speckle: measurements from diffusers of known statistics. B.M.Levine, J.C.Dainty (Inst. of Optics, Univ. of Rochester, Rochester, NY, USA).
Opt. Commun. (Netherlands), vol.45, no.4, p.252-7 (15 April 1983).
The second and higher moments of intensity in non-Gaussian image plane speckle patterns have been measured for deep phase screen diffusers. The diffusers were specially fabricated to have a Gaussian distribution of phase with a standard deviation in the range 6-9 rad and a Gaussian phase autocorrelation function of width ≈ 80 μm. Measurements of the second moment are in good agreement with the theoretical predictions of Jakeman and McWhirter (see Appl. Phys., vol.B26, p.125, 1981). (22 refs.)

66221 Wave-field statistics in scattering by a system of particles. A.G.Borovoi, A.V.Ivonin.
Opt. & Spectrosc. (USA), vol.53, no.3, p.329-30 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.557-9 (Sept. 1982). [received: May 1983]
The optical field scattered by a system of some large number N of randomly positioned particles is usually assumed to be a random Gaussian field. The assertion is based on the central-limit theorem ($N \rightarrow \infty$) of probability theory for the sum of independent random quantities. The authors show that such fields are not always Gaussian, and offer some criteria for transforming them into a Gaussian field. In particular, the transition to a Gaussian field in certain cases depends on the number of particles not throughout the illuminated region but only in some part of it. The authors note that these results are in accordance with the results on the statistics of fields that are propagating in turbulent media or behind random phase screens and of the fields reflected from rough surfaces. (5 refs.)

66222 Correction of angular displacements of optical beams. O.N.Emaleev, V.P.Lukin (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1470-4 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2264-71 (Nov. 1982). [received: May 1983]
One of the simplest algorithms for adaptive correction (correction of a random tilt of a wavefront) is considered in the case of a wide optical beam when a point reference source is used. An analysis is made of various algorithms for the determination of a random tilt. A calculation is made of the distribution of the average intensity of the corrected field. The results are given of an experiment carried out over a near-ground path. The problem of correlation of random tilts of a phase front and of high-frequency phase fluctuations is discussed. (20 refs.)

66223 Depolarized light scattering from large particles. B.A.Storonkin.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.91-3 (Feb. 1983). In Russian.
Dynamic light scattering from large optically anisotropic particles in external field is investigated. The depolarized components of spectral intensities of scattered light are obtained in various values of external field. (4 refs.)

Double-exposure speckle photography for the measurement of small displacements .... See Entry 64609

Three-dimensional interference-diffraction patterns .... See Entry 64626

Real-time longitudinal displacement analysis of rough surfaces by observing fringes within objective laser speckles .... See Entry 64881

Remarks about calibration of automatic analyser of aerosols .... See Entry 64883

Light scattering efficiency of dielectric spheres .... See Entry 66210

Quality of image transmission by light-scattering layers with different particle packing .... See Entry 66226

Use of focused light beams in schlieren instruments for studying randomly inhomogeneous media .... See Entry 66372

Interferometric analysis for small rotation .... See Entry 66528

Scattering of light by an intense saturating pulse in a resonance medium .... See Entry 66672

Image processing adapted to the atmosphere speckle. I. Speckle formation in turbulent atmosphere. Statistical properties .... See Entry 69323

Calculations of the intensity of a partially coherent optical beam in a turbulent atmosphere .... See Entry 69326

42.30 OPTICAL INFORMATION, IMAGE FORMATION AND ANALYSIS

66224 Application of Weigert effect to the pseudocoloration of a black and white signal. S.Debrus, M.P.Henriot, M.May (Inst. d'Optique., Univ. Pierre et Marie Curie, Paris, France).
Opt. Commun. (Netherlands), vol.45, no.4, p.241-3 (15 April 1983).
Proposes a method to transform the grey levels of a black and white transparency into different colours. The transparency to be processed, illuminated by a beam of linearly polarized white light, is twice recorded on a photographic silver-chloride emulsion. The direction of the light vector is rotated through $\pi/2$ between the exposures. The resulting plate is characterized by a spatially varying anisotropy. The main point is that the wavelength λ_B and λ_D, respectively corresponding to the cancellation of birefringence and dichroism,

are functions of the irradiance of the signal and of the successive exposure times. The plate is then illuminated in white light and observed between two polarizers P and A. It reconstructs an achromatic image of T when the respective axes of P and A are mutually perpendicular. A rotation of A from its setting crossed with P generates a colour distribution on the plate. (5 refs.)

66225 **Colour image enhancement by white light spatial filtering.** J.Santamaria, A.Plaza, J.Bescos (Inst. de Optica, Madrid, Spain).
Opt. Commun. (Netherlands), vol.45, no.4, p.244-51 (15 April 1983).
Colour enhancement of transparencies with degraded colours is obtained by attenuation of the zero order component of the white light spatial spectrum. The filtering is performed in two ways, directly and sequentially, and the efficiency of the enhancement is estimated through the measurement of the colour difference for several pairs of colours of the object. The method is described in detail and some colour results are presented. (14 refs.)

66226 **Quality of image transmission by light-scattering layers with different particle packing.** V.P.Dik, A.P.Ivanov, V.A.Loiko.
Opt. & Spectrosc. (USA), vol.53, no.3, p.301-4 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.512-16 (Sept. 1982). [received: May 1983]
Experimental study is done on the modulation-transfer function of a layer of dispersive medium for two kinds of particle packing: extremely dilute and dense. It is shown that cooperative phenomena appear for dense particle packing that leads to both deterioration and enhancement of image transmission. The bands of spatial frequencies and weighting of the dispersed substance considered here are determined at which enhancement of the contrast transfer is observed and the amount of variation of the modulation transfer coefficient is studied. As explanation is given of certain special features of image transmission by densely packed systems. (8 refs.)

66227 **Apodization of a passive coherent optical system for improving the image of the edge of a half-plane.** M.Ya.Mints, E.D.Prilepskii.
Opt. & Spectrosc. (USA), vol.53, no.3, p.311-14 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.529-34 (Sept. 1982). [received: May 1983]
Problems of apodizing a coherent passive optical system are considered to improve the image of the edge of a half-plane. The solutions obtained for the pupil function allow one to achieve an appreciable damping of intensity oscillations while retaining sufficient contrast in the image of the edge of a coherent object. (14 refs.)

66228 **Real-time edge enhancement in four-wave mixing with photorefractive BGO crystals.** Y.H.Ja (Telecom Australia Res. Labs., Clayton North, Australia).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.269-73 (May 1983).
Reports the edge enhancement using four-wave mixing (FWM) in a reflection geometry with highly sensitive photo-refractive $Bi_{12}GeO_{20}$ (BGO) crystals. (10 refs.)

66229 **Dilute uniformly redundant sequences for use in coded-aperture imaging.** W.J.Wild (Optical Sci. Center, Univ. of Arizona, Tucson, AZ, USA).
Opt. Lett. (USA), vol.8, no.5, p.247-9 (May 1983).
A class of binary sequences with ideal autocorrelation properties is given for several lengths. These sequences possess the property that their periodic autocorrelation sidelobes are a constant unity; they represent a class of codes that are both uniformly redundant and nonredundant. Application to coded-aperture imaging is discussed. (15 refs.)

66230 **Diffraction images of two dimensional elliptical objects.** A.Chandra, R.N.Singh, K.Singh (Phys. Dept., Indian Inst. of Technol., New Delhi, India).
Opt. Appl. (Poland), vol.12, no.2, p.243-52 (1982).
Presents a theoretical study of the diffraction images of elliptical objects formed by ideal systems having circular and angular apertures. The object illumination is assumed to be incoherent. Intensity distribution in the images has been evaluated by using the Fourier transformation approach. Results have been presented in the form of graphs along two directions in the image plane. (30 refs.)

66231 **The phase problem in object reconstruction and interferometry.** H.A.Ferwerda (Dept. of Appl. Phys., State Univ. of Groningen, Groningen, Netherlands).
Topical Meeting on Signal Recovery and Synthesis with Incomplete Information and Partial Constraints, Incline Village, NV, USA, 12-14 Jan. 1983 (Washington, DC, USA: Opt. Soc. America 1983), p.ThA1/1-4
Methods of phase retrieval from modulus data in one and two dimensions are reviewed in the context of object reconstruction and interferometry (including speckle). Interference microscopy is also considered. (13 refs.)

66232 **Phase retrieval for functions with sufficiently disconnected support.** T.R.Crimmins, J.R.Fienup (Environmental Res. Inst. of Michigan, Ann Arbor, MI, USA).
Topical Meeting on Signal Recovery and Synthesis with Incomplete Information and Partial Constraints, Incline Village, NV, USA, 12-14 Jan. 1983 (Washington, DC, USA: Opt. Soc. America 1983), p.ThA3/1-4
It is shown that the phase retrieval problem almost always has a solution unique among functions with disconnected supports satisfying a certain common separation condition. (5 refs.)

66233 **Omnidirectional viewing: the fish-eye lens problem.** N.Alvertos, E.L.Hall (Electrical Engng. Dept., Univ. of Tennessee, Knoxville, TN, USA), R.L.Anderson.
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.174-9
A fish-eye lens image can include information covering a 2π steradian field of view. These types of images appear with an unavoidable inherent distortion which can be corrected with image processing techniques. A method for geometric restoration of such distorted images is derived and its resolution is examined. After the final geometric restoration the image can be further improved by applying deblurring techniques. Examples of 'distorted' and 'undistorted' images are presented to clarify the results of the method described. (9 refs.)

Multiplier-type angle-measuring optical systems .... See Entry 64885

Accuracy of semiautomatic measurements on digitizing equipment .... See Entry 64891

Accuracy of an optical open area ratiometer .... See Entry 64939

Optical microscopy with extended depth of field .... See Entry 64950

Width-enhanced binary representation for library searching of vapor phase infrared spectra .... See Entry 64965

A simple method of evaluating the polychromatic modulation transfer function for photographic systems .... See Entry 64977

Correcting the residual astigmatism of complicated photographic systems .... See Entry 64983

Diffraction analysis of rotationally symmetric optical systems using computer-generated aberration polynomials .... See Entry 66203

The mean square error of the multiplicative model for speckle noise .... See Entry 66217

Non-Gaussian image plane speckle: measurements from diffusers of known statistics .... See Entry 66220

Reading and writing of photochemical holes using GaAlAs-diode lasers .... See Entry 66323

Chalcogenide glasses—promising materials for quantum electronics. I. Interaction and structure of glasses in the As-S system .... See Entry 66360

Evaluation of wave aberrations of objectives. III. Analysis of lateral shearing interferograms. Experimental results .... See Entry 66363

Chromatic aberration of a system of holographic lenses produced on non-plane surfaces .... See Entry 66364

Numerical analysis of the aberration for selected examples of holographic lenses on non-plane substrates .... See Entry 66365

Proposal of electro-optical switching and memory devices utilizing doping and undoping processes of conducting polymers .... See Entry 66371

Use of focused light beams in schlieren instruments for studying randomly inhomogeneous media .... See Entry 66372

Light-controlled transparencies for storing optical images .... See Entry 66407

Image processing adapted to the atmosphere speckle. I. Speckle formation in turbulent atmosphere. Statistical properties .... See Entry 69323

42.40 HOLOGRAPHY

(for acoustic holography, see 43.63)

66234 **Holographic interferometer for testing aspheric molds and molded parts.** S.D.Fantone (Optical Engng. Dept., Polaroid Corp., Cambridge, MA, USA).
Appl. Opt. (USA), vol.22, no.8, p.1121, 1126 (15 April 1983).
Describes a holographic interferometer which allows the testing of plastic aspheric surfaces against a standard derived from the mold insert. (no refs.)

66235 **Holography in engineering design.** C.Wykes (Dept. of Mech. Engng., Loughborough Univ. of Technol., Loughborough, England).
Engineering (GB), vol.223, no.4, p.262-5 (April 1983).
Optical techniques, such as holography, are becoming increasingly important in engineering design and measurement. As they are non-contacting, non-instrusive and allow large-scale views of surface displacements they have several advantages over mechanical systems such as strain gauges and accelerometers. The theory and applications are presented. (no refs.)

66236 **Diffraction of a light wave by a volumetric hologram in an anisotropic medium.** V.M.Serdyuk, A.P.Khapalyuk.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.836-9 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.132-6 (July 1982). [received: March 1983]
Considers the general laws governing the diffraction of light at volumetric holograms in anisotropic media. The structure of the dielectric-permittivity tensor and the electrooptical-coefficient tensor are not given in specific form, and the results obtained are applicable to various crystals, both uniaxial and biaxial. (8 refs.)

66237 **Dynamic holograms on free carriers in semiconductors.** A.A.Borshch, M.S.Brodin, V.I.Volkov, I.L.Romanenko.
Kvantovaya Elektron., Kiev (USSR), no.23, p.22-9 (1982). In Russian.
Surveys experimental work on the recording of dynamic phase holographic gratings in a wide range of semiconductors. On the basis of an analysis of the mechanisms of recording and erasure of holograms it is shown that there are certain restrictions superimposed on the efficiency and high-speed response of holograms on non-equilibrium free carriers. The authors examine various approaches to increasing the speed and diffraction efficiency of dynamic holograms in semiconductor crystals. (28 refs.)

66238 **The diffraction efficiency of holographic gratings made out of the photosensitive system As_2Se_3-As_2S_3-Ag.** M.T.Kostyshin, K.S.Mustafin, P.F.Romanenko, V.A.Seleznev.
Kvantovaya Elektron., Kiev (USSR), no.23, p.29-33 (1982). In Russian.
The basic characteristics of the As_2Se_3-As_2S_3-Ag system and also the results of experiments to raise the diffraction efficiency of holographic gratings recorded in this material are presented. It is shown that if low output power lasers are used to record gratings it is possible to achieve a diffraction efficiency of the order of 40% for polarised light and 34% for natural light. (10 refs.)

66239 **Possibility of discrete recording of information by a holographic method in the Fresnel diffraction zone.** S.N.Mensov, Yu.N.Zakharov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.307-11 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.522-8 (Sept. 1982). [received: May 1983]
The method of holographic recording of complex objects is used as an example to treat the question of the effect of spatial discretization of wave fields in the Fresnel diffraction zone on the quality of the image reconstructed from it. Recommendations are given for obtaining undistorted images in schemes with discrete recording of Fresnel holograms. (5 refs.)

66240 **Holography, coherent light amplification and optical phase conjugation with photorefractive materials.** P.Gunter (Lab. of Solid State Phys., Swiss Federal Inst. of Technol., ETH, Zurich, Switzerland).
Phys. Rep. (Netherlands), vol.93, no.4, p.199-299 (Dec. 1982). [received: April 1983]
The paper presents a review of photorefractive effects in electrooptic materials and their applications. Materials properties giving rise to increased photosensitivities are discussed and compared with experimental data for a series of newer materials. The formation of volume holograms in these crystals, and accompanying optical effects such as beam coupling and phase conjugation are discussed. Theoretical results derived from charge transport parameters are compared with the author's original data obtained in 'dynamic holography' experiments with $Bi_{12}GeO_{20}$, $Bi_{12}SiO_{20}$ and $KNbO_3$:Fe^{2+}. The optimum parameters for applications such as volume hologram storage, coherent light amplification, optical phase conjugation, etc., have been determined, and possible applications are discussed. (174 refs.)

66241 Holographic recording on board the Salyut-6 space station. N.M.Ganzherli, S.B.Gurevich, V.V.Kovalenok, B.Konstantinov, M.Cordero, I.A.Maurer, S.Mesa, R.Oms, S.A.Pisarevskaya, V.Rivera, M.Rivero, B.F.Ryadinskii, V.P.Savinykh, Yu.P.Semenov, M.S.Cheberyak, D.F.Chernykh (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1348-51 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2192-7 (Nov. 1982). [received: May 1983]
A test object, a three-dimensional body, and a dissolving crystal were recorded using the GA-1 holographic instrument specially designed for use in space. It is found that crystals dissolve more slowly under low-gravity conditions than they do on Earth (by a factor of $\sim$20). It is shown that the details of the outer surface of a viewport in the space craft can be recorded holographically. Holography can be used in control and test experiments in space. (2 refs.)

66242 Holographic image transmission in a closed TV system. S.P.Vorob'ev.
Tekh. Kino & Telev. (USSR), no.4, p.31-3 (April 1983). In Russian.
The conditions of distortionless holographic image transmission of document pages via a TV channel are considered. It is shown that for holographic image transmission, the bandwidth of 5-20 MHz is required. (11 refs.)

66243 Preliminary optical inspection of holographic images synthesized by using phototransparencies. N.K.Ignat'ev.
Tekh. Kino & Telev. (USSR), no.4, p.33-4 (April 1983). In Russian.
Describes a method of preliminary optical inspection of *3D* holographic images synthesized by using a set of phototransparencies. Inspection is carried out by viewing a sequence of specially oriented transparencies through a sequence of the same number of lenses with specially chosen focal lengths. Major data on the optical diagram are given. (2 refs.)

Real-time edge enhancement in four-wave mixing with photorefractive BGO crystals .... See Entry 66228

Chromatic aberration of a system of holographic lenses produced on non-plane surfaces .... See Entry 66364

Numerical analysis of the aberration for selected examples of holographic lenses on non-plane substrates .... See Entry 66365

Spatial light modulator .... See Entry 66379

Interferometric analysis for small rotation .... See Entry 66528

On stress analysis of anisotropic composites through transmission optical patterns: isochromatics and isopachics .... See Entry 66532

A method of three-dimensional strain measurement on non-ideal objects using holographic interferometry .... See Entry 66533

Measurement of the velocity of axisymmetric laminar flow by an optical visualisation technique with coherent light .... See Entry 66658

Limitation of the accuracy of interferometrically measured electron density profiles of laser-produced plasmas .... See Entry 66748

A holographic surface measurement of the Texas 4.9-m antenna at 86 GHz [space applications] .... See Entry 69507

42.50 QUANTUM OPTICS

66244 Semiclassical many-mode Floquet theory. T.-S.Ho, S.-I.Chu, J.V.Tietz (Dept. of Chem., Univ. of Kansas, Lawrence, KS, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.464-71 (15 April 1983).
It is shown that the single-mode Floquet formalism of Shirley (1965) can be extended to a generalized many-mode Floquet theory, yielding a practical non-perturbative technique for the semiclassical treatment of the interaction of a quantum system with several monochromatic oscillating fields. The theory is illustrated by a detailed study of the population dynamics of a three-level system drive by two monochromatic radiation fields. (17 refs.)

66245 The rotating-wave approximation in bound-free transitions. J.Javanainen (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland).
J. Phys. B (GB), vol.16, no.8, p.1343-61 (28 April 1983).
The author solves the Schrodinger equation in terms of continued fractions for a system exhibiting light-induced bound-free transitions over an energy gap, without making the rotating-wave approximation. He describes the evolution of the bound state and the photoelectron spectrum by investigating the analytic properties of the Fourier transforms of the probability amplitudes. The main consequence of non-RWA transitions is a Bloch-Siegert shift of the continuum threshod, which may be comparable to RWA dynamic level shifts. At high intensities the counter-rotating wave also influences the evolution of the bound state, and gives rise to multiphoton transitions competing with RWA multiphoton transitions with an odd number of photons, but these effects are probably hard to isolate experimentally. (22 refs.)

66246 Sidebands in cooperative resonance fluorescence in collections of *N* three-level atoms in strong excitation laser fields. C.C.Sung, C.M.Bowden (Us Army Missile Lab., US Army Missile Command, Redstone Arsenal, AL, USA).
Opt. Commun. (Netherlands), vol.45, no.4, p.273-7 (15 April 1983).
It is shown that, in addition to an Autler-Townes doublet, the resonance fluorescence spectrum of *N* three-level atoms consists of sidebands separated by three pump Rabi frequencies and much reduced in intensity to the symmetrically-located central doublet. The sidebands are due to cooperative atomic interaction. (18 refs.)

66247 Superrradiance: an essay on the theory of collective spontaneous emission. M.Gross, S.Haroche (Lab. de Phys., Ecole Normale Superieure, Paris, France).
Phys. Rep. (Netherlands), vol.93, no.5, p.301-96 (Dec. 1982). [received: April 1983]
This essay presents a theoretical description of the superradiance phenomenon, in which both the quantal and the classical aspects are discussed. Starting from the simple two-level atom-small sample Dicke model the authors successively introduce various complications inherent to a realistic superradiance experiment: effects of Van der Waals interaction between the atoms, propagation and diffraction of the electromagnetc field in the sample and finally the effects related to atomic level degeneracy or near degeneracy. They recall how to calculate the field radiated by a superradiant system in a single experiment and how to determine, for a series of identically prepared superradiant samples, the large shot to shot fluctuations of the emitted light properties. The presentation tries to unify various points of view and formalisms developed in previous works and to introduce simply and progressively the basic physical concepts relevant to the superradiance phenomenon. (98 refs.)

66248 Theory of the spectrum of the quantised light field. J.D.Cresser (Max-Planck-Inst. fur Quantenoptik, Garching, Germany).
Phys. Rep. (Netherlands), vol.94, no.2, p.47-110 (Jan. 1983).
The formal classical concepts of spectrum, well-founded as part of the theory of stochastic processes, has been applied extensively to the analysis of the properties of classical light fields. In the case of quantum mechanical light fields, the concept of spectrum has not been so well defined, and approaches of considerable diversity have been used to develop various quantum definitions. A review is given of the various ways in which the quantum definitions have been formulated, and a comparison with the classical stochastic theory presented, with the emphasis on the role of the statistical ensemble in formulating the classical definitions. Arguments are presented which suggest that the formal classical approach cannot in fact be followed in the quantum regime, so that the various quantum definitions cannot in general be intepreted in the same way as in the classical case. However, by adopting an operational point of view based on the use of a two level atom as a field detector (the Scully-Lamb-Glauber model), it is possible to formulate a definition of the quantised field which admits a satisfactory physical interpretation but which also, in an operational sense, puts the quantum and classical definitions on an equal footing. This definition is analysed in detail in the quantum case, in particular in the case of the light field being coupled to its sources. (92 refs.)

Nonlinear stochastic processes driven by colored noise: application to dye-laser statistics .... See Entry 66268

Amplification and measurement of single 1.6-3.5 ps pulses generated by a distributed feedback dye laser .... See Entry 66306

42.52 MASERS

66249 Dynamics of multimode electron masers. L.G.Blyakhman, G.S.Nusinovich.
Radio Eng. & Electron. Phys. (USA), vol.27, no.5, p.137-44 (May 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.5, p.996-1004 (May 1982). [received: April 1983]
The energy and phase interactions of modes in multimode masers are investigated. If the self-excitation threshold of the oscillator is exceeded by a small amount and modes close to the natural frequencies are involved, then the primary nonlinear effect in the mode interaction is their competition, leading to the establishment of one-mode oscillations. When the beam current exceeds the starting values by a larger amount, a mode with a low starting current turns out to be in a position to maintain, because of the dispersion of the electron-beam nonlinearity, the oscillations of a higher frequency mode, whose increment may be positive or negative. As shown for the example of a gyrotron, the establishment of a mutual mode synchronization regime is possible, because of this effect, in an oscillator with three modes that are considerably separated in frequency (on the scale of the cyclotron-resonance bandwidth). (17 refs.)

42.55 LASING PROCESSES

42.55B General theory of lasing action

66250 Thermodynamics of daylight-pumped lasers. C.B.Roxlo, E.Yablonovitch (Exxon Res. & Engng. Co., Linden, NJ, USA).
Opt. Lett. (USA), vol.8, no.5, p.271-3 (May 1983).
The authors cast the problem of very-low-threshold, daylight-pumped lasers in a general thermodynamic framework. The authors calculate that the requirements to reach threshold are that the Stokes shift of such a laser be greater than 13.3kT and that the absorption ratio of the pump/emission band and the geometrical aspect ratio both be greater than exp (13.3). The authors describe some luminescent material systems that might be able to satisfy these rigid requirements. (9 refs.)

66251 Gas laser with a phase anisotropy in an axial magnetic field for arbitrary relative excitation of the active medium. A.Ch.Izmailov (Engng. Phys. Inst., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1411-15 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2172-8 (Nov. 1982). [received: May 1983]
A theoretical analysis is made of the characteristics of a single-and two-mode gas laser with an anisotropic resonator in an axial magnetostatic field with arbitrary relative excitation of the active medium for an atomic transition with total level momenta of 0 and 1. Using an example of a homogeneously broadened spectral line, it is shown that the results of calculations made to within terms cubic with respect to the electric field give a correct qualitative description of the characteristics of two-mode lasing. (10 refs.)

66252 Natural fluctuations in a multimode standing-wave laser. V.R.Mironenko, V.I.Yudson (Inst. of Spectroscopy, Acad. of Sci., Troitsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1452-7 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2234-43 (Nov. 1982). [received: May 1983]
It is shown theoretically that the relative fluctuations in the numbers of photons in individual modes of a multimode standing-wave laser with a homogeneously broadened gain profile is extremely sensitive to the degree of filling of the resonator with the active medium. If this medium fills the whole resonator, the spatial effects result in strong suppression of fluctuations in the individual modes. In the opposite case of a thin medium the statistical properties of a multimode standing-wave laser are close to those of a travelling-wave laser. The conclusions reached are used in an analysis of the quantitative discrepancy between the results of published experimental studies of the statistics of multimode lasing. (18 refs.)

42.55D CO_2 lasers

66253 Runaway self-absorption in multikilowatt CO_2 lasers. A.S.Kaye, D.L.Naylor (UKAEA Culham Lab., Abingdon, England).
Appl. Phys. Lett. (USA), vol.42, no.8, p.641-2 (15 April 1983).
Runaway self-absorption within a CO_2 laser cavity, recently reported at high pressure, has also been observed in a low pressure (50 mbar), multikilowatt CW CO_2 laser. A numerical model of the laser discharge is used to simulate the runaway absorption and gives results consistent with experiment. Runaway absorption is readily suppressed by eliminating regions of stagnant gas within the cavity. (3 refs.)

Inverse Lamb dip spectroscopy using microwave modulation sidebands of CO_2 laser lines ..... See Entry 64966

Vibrational kinetics of CO_2 during intense excitation of Fermi resonance modes ..... See Entry 66100

Effects of optical irregularities in the active medium on angular divergence of a beam in a CW supersonic DF-CO_2 chemical laser ..... See Entry 66263

Carbon dioxide laser with sequential transitions and a composite resonator ..... See Entry 66298

Voltage drop at the cathode of a glow discharge at moderate pressures in nitrogen and in a mixture of CO_2-laser gases ..... See Entry 66768

42.55F Inert gas lasers

66254 Heavy ion beam pumped He-Ar laser. A.Ulrich, H.Bohn, P.Kienle, G.J.Perlow (Dept. of Phys., Tech. Univ. Munchen, Garching, Germany).
Appl. Phys. Lett. (USA), vol.42, no.9, p.782-4 (1 May 1983).
A 100-MeV ^{32}S beam was used to pump a He-Ar gas laser. Laser action of the 1.79-μm line was observed above a threshold of 33-W beam power input. The light conversion efficiency is about 1×10^{-4} with a (88%)He-(1%)Ar gas mixture at 200-mbar pressure and 132-W input power. (4 refs.)

66255 Plamsa oscillations in an ion argon laser. I.E.Sakharov, S.V.Shatalin (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1363-6 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2218-23 (Nov. 1982). [received: May 1983]
Experimental results are reported concerning plasma instability in an ion argon laser. This instability, which was discovered in earlier work, limits the extent to which the gain can be increased by raising the electron temperature. The plasma instability is of the current cutoff type and is initiated by thermal instability resulting in linear pinching. In systems with a cold field emission cathode, beams of 'runaway' electrons may play an important role. (13 refs.)

Gas laser with a phase anisotropy in an axial magnetic field for arbitrary relative excitation of the active medium ..... See Entry 66251

Manufacturing the laser tube [for measurement system] ..... See Entry 66294

Gas-lens effect and cavity design of some frequency-stabilized He-Ne lasers ..... See Entry 66305

Comparison between the $^{127}I_2$ stabilized He-Ne lasers at 633 nm and 612 nm of the BIPM and the IMGC ..... See Entry 66307

International intercomparison of laser power measurements in the visible region ..... See Entry 66308

Results of international comparisons using methane-stabilized He-Ne lasers at 3.39 μm and iodine-stabilized He-Ne lasers at 633 nm ..... See Entry 66309

Intracavity generation of second harmonics and sum frequencies in $LiIO_3$ crystal in an infrared He-Ne laser ..... See Entry 66335

Photographic study of voltage breakdown over an insulator in a hypocycloidal pinch ..... See Entry 66765

42.55H Lasing action in other gas lasers

66256 Theoretical evaluation of the rare-gas diluent effects for an electron-beam-excited XeCl laser. F.Kannari, A.Suda, M.Obara, T.Fujioka (Dept. of Electrical Engng., Keio Univ., Yokohama, Japan).
Appl. Phys. Lett. (USA), vol.42, no.9, p.766-8 (1 May 1983).
The effect of various rare-gas diluents on the operating performance of the *e*-beam-excited XeCl laser is theoretically analyzed. The analysis of the XeCl* pumping process and the extraction process could solve the dependence of the intrinsic efficiency, small-signal gain, and absorption on the rare-gas diluent. As a result, there is no appreciable difference in the intrinsic efficiency between the Ar-based and the Ne-based mixtures. Selecting the optimum excitation parameters, the highest intrinsic efficiency of 5% is achieved for both diluents. Although the highest small-signal gain is achieved without a diluent gas, the extraction efficiency is reduced and the intrinsic efficiency is small due to the large amount of three-body collisional quenching. (11 refs.)

66257 A high-power, narrow linewidth XeCl* oscillator. O.L.Bourne, A.J.Alcock (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Canada).
Appl. Phys. Lett. (USA), vol.42, no.9, p.777-9 (1 May 1983).
A narrow linewidth ($\Delta\lambda$0.0004 Å) modular dye laser system has been constructed and used to investigate the gain characteristics of a XeCl* oscillator. When operated as a free-running oscillator lasing occurred simultaneously on the $B_{\nu=0}\rightarrow X_{\nu=1}$ and $B_{\nu=0}\rightarrow X_{\nu=2}$ transitions. The injection of 20 μJ of UV radiation from the dye chain was sufficient to confine the entire output to either one of these two transitions. A measured linewidth of 0.00004 Å was obtained at average power levels of up to 5 W. (18 refs.)

66258 FIR NH_3 cascade laser excited by a Q-switch laser. J.W.Won, G.D.Willenberg (Phys.-Tech. Bundesanstalt, Braunschweig, Germany).
Appl. Phys. B (Germany), vol.B31, no.1, p.5-8 (May 1983).
Short FIR laser pulses of high repetition rate are obtained by pumping NH_3 with the pulses of a passively Q-switched IR laser. The two cascade laser transitions observed show coupled relaxation oscillations. The pulse shapes and delay times are qualitatively in agreement with a four-level rate-equation model. (17 refs.)

66259 Preionization kinetics of an X-ray preionized XeCl gas discharge laser. H.Shields (Div. of Phys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada), A.J.Alcock, R.S.Taylor.
Appl. Phys. B (Germany), vol.B31, no.1, p.27-35 (May 1983).
The influence of preionization conditions on the performance of a XeCl gas discharge laser preionized by a short, high intensity X-ray pulse, has been studied. The laser output energy and optical pulse temporal characteristics have been used to determine the roles of initial electron density and of electron attachment to HCl and to impurities. Although the short pulse preionization technique functions well for XeCl when the laser voltage pulse has a short risetime ($\lesssim$20 ns), it is less well suited to XeCl lasers using slowly rising voltage pulses (>50 ns), or to F_2 containing gas mixtures (KrF and XeF lasers). (27 refs.)

66260 Effect of striations on the output characteristics of a He-Cd laser. V.A.Vaskov, S.A.Gonchukov, E.V.Kurbatov, E.D.Protsenko.
Opt. & Spectrosc. (USA), vol.53, no.3, p.320-1 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.544-6 (Sept. 1982). [received: May 1983]
The most likely mechanism for the effect of striations on the characteristics of the He-Cd laser is an additional two-step excitation of the working levels by fast electrons that appear when striations are crossed. The authors studied the waves in the plasma and their effect on the level populations and laser output within a narrow frequency interval, tunable over the entire range in which waves exist. By taking this approach they were able to study waves separately in the region in which striations exist and in which combinations of striations exist, and in addition were able to determine the roles played by these regions in the effect on the characteristics of the cataphoresis laser. It is concluded that an additional two-step excitation of levels by fast electrons occurs only when there are striation beats in the positive column of the discharge. The apparent reason for this effect is a substantial angular alignment of the electron velocities with the phase velocities of the waves in the plasma. (8 refs.)

66261 Excitation of laser transitions in parametallic gas mixtures using reaction products from nuclear reactions. A.B.Dmitriev, V.S.Il'yashenko, A.I.Mis'kevich, B.S.Salamakha.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1373-4 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2235-7 (Nov. 1982). [received: May 1983]
Luminescence is studied at high pressure in parametallic gas mixtures excited by products from neutron nuclear reactions. The use of ^{3}He-Cd, ^{3}He-Hg, and ^{3}He-Cs mixtures as active laser media pumped by nuclear reactions is considered. Quasicontinuous lasing in a ^{3}He-Cd mixture excited by a stream of neutrons is reported. (8 refs.)

A quadruple transmission line nitrogen laser ..... See Entry 66296

International intercomparison of laser power measurements in the visible region ..... See Entry 66308

Estimation of the minimum laser linewidth achievable with a grazing-grating configuration ..... See Entry 66313

Three-frequency Raman-amplification source (theory) ..... See Entry 66332

Photographic study of voltage breakdown over an insulator in a hypocycloidal pinch ..... See Entry 66765

Experimental study of an axial discharge in a turbulent gas flow ..... See Entry 66770

42.55K Chemical lasers

(see also 82.40T Chemiluminescence and chemical laser kinetics)

66262 Enhanced HgBr($B^2\Sigma^+\rightarrow X^2\Sigma^+$) emission at low pressures. W.P.Lapatovich, G.R.Gibbs, J.M.Proud (GTE Labs., Inc., Waltham, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.792-4 (1 May 1983).
Additives of N_2 and I_2 vapour in diffuse $HgBr_2$ discharges have been observed to produce a large enhancement of radiated power due to $B^2\Sigma^+\rightarrow X^2\Sigma^+$ transitions at low pressures. The integrated power in the spectral range between 374 and 543 nm was recorded by means of an optical multichannel analyzer system. Optimization of the $B\rightarrow X$ radiation was investigated, and absolute efficiency was determined over a range of $|E|/N$. (13 refs.)

66263 Effects of optical irregularities in the active medium on angular divergence of a beam in a CW supersonic DF-CO_2 chemical laser. N.A.Konoplev, A.A.Stepanov, V.A.Shcheglov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1370-3 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2229-34 (Nov. 1982). [received: May 1983]
The effects of optical irregularities in the active medium caused by gas dynamic expansion on the divergence of the output light are studied by treating the example of a supersonic DF-CO_2 chemical laser in the amplification mode with a cylindrical nozzle unit and radial gas pumping. Direct calculations using the diffraction equations indicate that laser light divergence becomes much worse when such optical irregularities are present. Ways for reducing beam divergence under these conditions are discussed. (10 refs.)

Characteristics of a pulsed chemical laser utilizing an H_2-F_2 mixture and initiated by radiation from an XeCl excimer laser ..... See Entry 66299

Experimental investigation of the characteristics of a planar surface discharge ..... See Entry 66774

42.55M Lasing action in liquids and organic dyes

66264 Laser dye stability. IX. Effects of a Pyrex UV filter and cover gases. A.N.Fletcher (Dept. of Res., Naval Weapons Center, China Lake, CA, USA).
Appl. Phys. B (Germany), vol.B31, no.1, p.19-26 (May 1983).
A figure-of-merit (FOM) consisting of the initial laser slope efficiency times the dye lifetime constant is used to compare the effect of a Pyrex light filter and the cover gas upon the output characteristics of six laser dye solutions. The FOM is found to improve using the Pyrex filter from 2-fold (coumarin 102 under air) up to 3800-fold (rhodamine 6 G under argon). In most cases, the use of argon in place of air for a coumarin dye not only improves the laser output, but also increases the lifetime constant. In order to measure long-lived dye solutions, a separate output-monitored linear flashlamp was used to degrade the solutions. The lifetime constants of the dye LD-490 measured by using the coaxial laser flashlamp was found to be comparable with, but lower than, the constants obtained from using the linear dye-degradation flashlamp. (24 refs.)

66265 Lasing characteristics of deoxygenated solutions of laser dyes. M.M.Asimov, V.N.Gavrilenko, A.N.Rubinov.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.769-73 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.49-54 (July 1982). [received: March 1983]
Values are presented of the molecular constants which regulate the populating (P_{32}) and deactivation (P_{21}) of the T_1 state of some laser dyes in oxygenated and degassed ethanol solutions. The removal of O_2 was achieved either by cyclic freezing with evacuation to an air pressure of $\sim10^{-3}$ torr or by saturating the solutions with helium for 30-40 min when it was impossible to work with sealed cuvettes. The spectroscopic parameters of the triplet state of the dye molecules were determined on a laser spectrophotometer. (20 refs.)

66266 Theoretical and experimental investigation of electronically excited states, luminescence properties, and lasing capability of pyrene and its phenylethynyl derivatives. O.K.Bazyl', G.V.Maier, T.N.Kopylova, V.I.Danilova.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.794-9 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.80-6 (July 1982). [received: March 1983]
The lasing action of the complex organic molecules has been investigated with the application of the theoretical methods of quantum chemistry, since such an approach makes it possible to establish the relationship between the lasing capability of molecules and their structure. (20 refs.)

66267 Photon conservation in flashlamp pumped dye lasers. R.H.Knipe (Res. Dept. Naval Weapons Center, China Lake, CA, USA).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.275-8 (May 1983).
A general representation of the laser output per pulse of the flashlamp is deduced from an equivalence between molecules populating the upper state of the lasing transition and coherent photons populating the active cavity modes. This representation is used to derive approximate expressions relating the slope efficiency and threshold to the losses associated with the laser system. (6 refs.)

66268 Nonlinear stochastic processes driven by colored noise: application to dye-laser statistics. S.N.Dixit, P.S.Sahni (Corporate Res.-Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1273-6 (25 April 1983).
The role of multiplicative colored noise on the photon statistics of the dye-laser output is investigated. This model explains consistently the recent experimental results by Short, Mandel, and Roy (1982). (10 refs.)

66269 Coumarin 6 as the active medium of a dye vapor laser with wide-band optical pumping and specific characteristics of such lasers. K.K.Trusov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1425-8 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2192-7 (Nov. 1982). [received: May 1983]
An experimental investigation was made of the efficiency of conversion of flashlamp pump radiation to fluorescence of coumarin 6 at a buffer gas pressure of 0-1 MPa. The lasing dynamics of the flashlamp-pumped vapor of this compound was also studied. It was found that the fluorescence quantum efficiency averaged over the absorption spectrum, which characterized the pump conversion efficiency, was $\langle\eta\rangle \leq 03$ at a buffer gas pressure of 0-1 MPa. Dependence of $\langle\eta\rangle$ and the rate constant for optical bleaching of the dye on the buffer gas pressure were determined. A comparative analysis of the lasing dynamics of coumarin 6 in vapors and in an ether solution showed that the gas phase had a higher lasing threshold (18-20 times higher) and a larger increment of loss growth in the spectral range of lasing (four times higher). It also has a shorter maximum lasing duration ($t_{max} \approx 500$ nsec). (9 refs.)

Amplification and measurement of single 1.6-3.5 ps pulses generated by a distributed feedback dye laser .... See Entry 66306

Dye laser spectrum narrowing by 'double pulse' flashlamp pumping ....See Entry 66310

Significance of intra-cavity power density in synchronous mode-locking of CW-dye lasers .... See Entry 66311

42.55P Lasing action in semiconductors with junctions

66270 On the linewidth enhancement factor α in semiconductor injection lasers. K.Vahala, L.C.Chiu, S.Margalit, A.Yariv (California Inst. of Technol., Pasadena, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.631-3 (15 April 1983).
A simple model for the linewidth enhancement factor α and its frequency dependence in semiconductor lasers is presented. Calculations based on this model are in reasonable agreement with experimental results. (12 refs.)

66271 Phase-locked (GaAl)As laser emitting 1.5 W CW per mirror. D.R.Scifres, R.D.Burnham, C.Lindstrom, W.Streifer, T.L.Paoli (Xerox Palo Alto Res. Centers, Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.645-7 (15 April 1983).
A phase-locked multiple quantum well (GaAl)As injection laser is demonstrated to emit over 1.5 W/mirror (>3 W total) CW output power at ~8350 Å with a maximum power conversion efficiency of 17.4%. (15 refs.)

66272 Twin-channel substrate-mesa-guide injection lasers fabricated by organometallic vapor phase epitaxy. D.E.Ackley, G.Hom (Hewlett-Packard Labs., Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.653-5 (15 April 1983).
An easily fabricated high-power index-guided laser, the twin-channel substrate-mesa-guide (TCSM) laser, has been developed for applications in recording, printing, and communications. The TCSM laser is fabricated by one-step organometallic vapor phase epitaxy (OMVPE) on photolithographically patterned and etched substrates. Linear output characteristics were observed to 40 mW CW with corresponding operation in zero order lateral and transverse modes and no astigmatism. Stable single longitudinal mode oscillation also resulted from the strong refractive index guiding produced by the nonplanar structure. (8 refs.)

66273 Photopumped low threshold $Al_{x''}Ga_{1-x''}As$-$Al_{x'}Ga_{1-x'}As$-$Al_xGa_{1-x}As$ ($x'' \sim 0.85$, $4ix' \sim 0.3$, $x=0$) single quantum well lasers. M.D.Camras, N.Holonyak,Jr., M.A.Nixon (Materials Res. Lab., Univ. of Illinois, Urbana, IL, USA), R.D.Burnham, W.Streifer, D.R.Scifres, T.L.Paoli, C.Lindstrom.
Appl. Phys. Lett. (USA), vol.42, no.9, p.761-3 (1 May 1983).
Data are presented showing that it is possible to photopump and operate a quantum well heterostructure laser at equivalent current densities (J_{eq}) as low as 70 A/cm^2. Continuous 300-K laser operation of a single 60-Å GaAs ($x=0$) quantum well the center of a ~0.12-μm-thick $x' \sim 0.30$ $Al_{x'}Ga_{1-x'}As$ waveguide (and carrier reservoir), which is confined by $x'' \sim 0.85 Al_{x''}Ga_{1-x''}As$ layers, is demonstrated at $I_{eq} \sim 0.4$ mA (168 W/cm^2, $J_{eq} \sim 70$ A/cm^2). These quantum well heterostructures are grown by organometallic vapor phase epitaxy. (14 refs.)

66274 High-frequency impedance of proton-bombarded injection lasers. B.W.Hakki, W.R.Holbrook, C.A.Gaw (Bell Labs., Murray Hill, NJ, USA).
Bell Syst. Tech. J. (USA), vol.62, no.2, pt.1, p.463-75 (Feb. 1983).
Experimental and theoretical results are given of an investigation of the capacitance behavior with frequency of GaAs injection lasers. It is shown that, for shallow-bombarded stripe geometry lasers, the zero-bias capacitance decreases rapidly beyond a certain frequency. This is interpreted in terms of confinement of the low-level radio frequency current under the stripe at high frequencies. Comparison of the experimental results with the analytically derived expressions provides a measure of the material resistivity adjoining the active region. This inferred material resistivity is shown to be in good agreement with results obtained by more direct measurements. Finally, the general conclusions are also applicable to other optoelectronic devices operating at high frequency, such as light-emitting diodes. (25 refs.)

66275 Feedback-induced noise in index guided semiconductor lasers and its reduction by modulation. K.Stubkjaer, M.B.Small (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Electron. Lett. (GB), vol.19, no.10, p.388-9 (12 May 1983).
The authors report a reduction in feedback noise of 15 to 20 dB by direct modulation of the laser with a 265 mA modulation current. The reduction is almost independent of modulation frequency in the frequency range from 50 MHz to 200 MHz, but depends on the external cavity length. The external cavity lengths considered are 5 to 15 cm. (7 refs.)

66276 Carrier transport in stripe-geometry $Ga_{1-x}Al_xAs$ double heterostructure diode lasers and broad area heterojunctions. A.Zemel, H.W.Willemsen, K.D.Anderson, F.R.Shepherd (Bell-Northern Res., Ottawa, Ontario, Canada).
J. Appl. Phys. (USA), vol.54, no.4, p.1981-7 (April 1983).
The current-voltage characteristics of stripe-geometry double heterostructure diode lasers and broad area heterojunctions of $Ga_{1-x}Al_xAs$ prepared by liquid-phase epitaxy have been extensively studied as a function of temperature and diode area to perimeter ratio. For stripe-geometry lasers, current-voltage measurements were made up to the lasing threshold (~10^4 A/cm^2). The carrier transport mechanisms in different ranges of current densities were identified and interpreted on the basis of existing models for *p-n* junctions. It is found that 2-kT current in combination with a tunneling current of the form $I\alpha \exp(T/T_0)\exp(AV)$ where T_0 and A are constants essentially independent of temperature, are the major contributions to the diode current at low forward bias. The 2-kT current is most probably due to surface recombination occurring at the junction perimeter and the tunneling current is most probably related to defects generated in the diode depletion region during epitaxial growth and/or sample processing. At medium forward bias, pure 1-kT current limited by the rate at which electrons can diffuse in the narrow gap *p*-type semiconductor is dominant. In the laser devices 2-kT current consistent with high injection conditions, is found at current densities near threshold. To the best of the authors' knowledge, this is the first time high injection behavior has been recognized and demonstrated in diode laser devices. (15 refs.)

66277 Astigmatism and spontaneous emission factor of laser diodes with parabolic gain. T.Mamine (Semiconductor Res. Dept., SONY Corp., Atsugi-shi, Japan).
J. Appl. Phys. (USA), vol.54, no.4, p.2103-5 (April 1983).
An explicit relation between the astigmatism and the spontaneous emission factor of gain guiding lasers has been derived with the assumption that the grain profile can be approximated to be a parabola or that the lowest order mode in the cavity is approximately Gaussian. The maximum value of the spontaneous emission factor is shown to be $\sqrt{2}$ if index guiding is dominant. Beyond $K=\sqrt{2}$, where gain guiding is dominant in this region, the astigmatism decreases with the spontaneous emission factor. It is also shown that the spontaneous emission factor of the gain guiding lasers does not much exceed ten and this conclusion has been confirmed experimentally for those whose stripe widths are larger than 4 μm. (8 refs.)

66278 A decisive state for laser diodes.
Mes. Regul. Autom. (France), vol.48, no.3, p.61-2 (7 March 1983). In French.
A new method of gas-phase growth of double-heterojunction GaAlAs, developed by the Thomson CSF central research laboratory, is described. It yields laser diodes with very low threshold and power consumption. The method should also permit epitaxy on to an InP substrate for the GaInAsP alloy base of 1.2 to 1.6 micron laser diodes. A threshold current density as low as 120 A/cm^2 for an optical cavity length of 1.8 mm is claimed. The 1000 Å thickness of the carrier recombination associated with conventional LPE is reduced to 60 Å with the aid of an epitaxial gas of organometallic compounds at reduced pressure. Excellent prospects for mass production by this method are foreseen. The use of proton implantation to produce a locally insulating region around the 5-micron active zone is explained diagrammatically. (no refs.) *M.B.D.*

66279 A classification scheme for the light-current (L/I) characteristics of a two photon mode semiconductor laser. S.J.Chua (Electrical Engng. Dept., Nat. Univ. of Singapore, Kent Ridge, Singapore).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.231-40 (May 1983).
The behaviour of a semiconductor laser in which two photon modes exist above threshold is analysed using the rate equations. The author classifies the different qualitative behaviour of mode competition by using a single parameter γ. The simplified analysis, neglecting electronic diffusion is sufficient to explain the experimental L/I characteristics of weak and strong polarization in semiconductor lasers which were previously treated theoretically using a power distribution model. (10 refs.)

66280 Chirp in picosecond film lasers and pulse compression by linear dispersion in optical fibers. J.M.Weisenfeld, J.Stone (Bell Labs., Holmdel, NJ, USA).
Opt. Lett. (USA), vol.8, no.5, p.262-4 (May 1983).
Time-averaged and time-resolved spectra of single-mode, optically pumped, ultrashort-cavity semiconductor film lasers have been studied in detail. The time-averaged spectra are broad (3-17 nm). Time-resolved spectra show that the lasing wavelength increases (chirps) during the picosecond-time-scale duration of the pulse. This chirp is due to free-carrier plasma effects on the refractive index of the highly excited semiconductor (<10^{20} carriers/cm^3). Film-laser pulses are compressed by a factor of 2 in an 8-m length of single-mode optical fiber because of the linear group-velocity dispersion of the fiber, producing a pulse of 3.7-psec duration at 1.264 μm. (19 refs.)

66281 Analysis of factors influencing the threshold current of $Pb_{1-x}Sn_xSe$ injection heterolasers. L.P.Bychkova, O.I.Davarashvili, P.G.Eliseev, M.I.Saginuri, R.I.Chikovani, A.P.Shotov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1391-7 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2140-50 (Nov. 1982). [received: May 1983]
An analysis is made of the factors which influence the threshold current in $PbSe/Pb_{1-x}Sn_xSe$ injection heterolasers. These factors include the waveguide structure, electron confinement, inhomogeneity of the distribution of the gain across the thickness, nonradiative recombination at the heterojunctions and in the bulk, and temperature. The conditions are identified under which anomalies can be expected in the temperature dependence of the threshold current because of the influence of free carriers on the refractive index. The results agree with the experimental values of the threshold current density for a surface recombination velocity of ~2×10^5 cm/sec and an internal quantum efficiency of ≤0.1. (18 refs.)

Demonstration of multilevel multichannel optical frequency shift keying (FSK) with cleaved-coupled-cavity (C^3) semiconductor lasers .... See Entry 66293

The application of 'organometallic' technology to the growth of GaAs/GaAlAs laser structures .... See Entry 66297

Investigation of CW operation of a GaAs laser pumped by an electron beam ...
....See Entry 66300

High-speed direct single-frequency modulation with large tuning rate and frequency excursion in cleaved-coupled-cavity semiconductor lasers ....
....See Entry 66302

Modal analysis of separate-confinement heterojunction lasers with inhomogeneous cladding layers .... See Entry 66314

Chromatic dispersion measurements in single-mode fibers using picosecond InGaAsP injection lasers in the 1.2- to 1.5-μm spectral region .... See Entry 66392

42.55R Lasing action in other solids
(inc. solid Raman lasers)

66282 **Laser oscillation at 3.53 μm from Fe^{2+} in n-InP:Fe.** P.B.Klein, J.E.Furneaux, R.L.Henry (Naval Res. Lab., Washington, DC, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.638-40 (15 April 1983).
Using pulsed optical excitation ($h\nu > E_g$), the authors have observed laser oscillations at 3.53 μm from the internal d-shell transitions of Fe^{2+} in n-type InP:Fe. The semiconducting nature of the InP host plays an important role in the pumping of the Fe^{2+} excited state, which occurs via the capture of a conduction-band electron by Fe^{3+} created during the exciting pulse. (8 refs.)

66283 **Amplification in a solid-state gamma-ray laser.** V.I.Vysotskii, V.I.Vorontsov.
Kvantovaya Elektron., Kiev (USSR), no.23, p.3-8 (1982). In Russian.
The authors examine the mutual influences of excited and unexcited nuclei on the resonance reaction cross section ratio. It is shown that as a consequence of the difference between the magnetic moments of the ground- and excited-state nuclei there occurs a displacement and broadening of the resonance transition line. For an ordered lattice such an effect leads to the resonance gamma-ray absorption cross section changing by a factor of 10-1000 or more for a given amplification cross section. The possibility of applying such an effect in a non-threshold gamma-ray laser is discussed. (8 refs.)

66284 **Concerning the mechanism of laser generation, the thickness of the active layer, the effects of natural resonances and the nature of the M and P-bands in CdS emission spectra during excitation by a nitrogen laser.** A.A.Kipen', N.I.Yanushevskii, N.I.Vitrikhovskii.
Kvantovaya Elektron., Kiev (USSR), no.23, p.9-22 (1982). In Russian.
Investigates the emission spectra (spontaneous and stimulated, including the generation regime) and the amplification spectra of CdS (at temperatures of 4.2-420K) during excitation by a nitrogen laser, taking into account the influence of the natural cavity resonator of the specimen on its recombination spectra at high excitation levels. It is concluded that the dominant mechanism giving rise to laser generation in the CdS is radiative electron-electron inelastic scattering. The thickness of the active layer is evaluated for a wide range of excitation levels. A new point of view is expressed on the nature of the most characteristic bands arising in the radiation of strongly excited single crystals of CdS. (33 refs.)

66285 **Development of colour centre lasers for spectroscopy applications.** G.Baldacchini, G.P.Gallerano (ENEA Frascati, Roma, Italy), D.Censi, M.Tonelli, P.Violino, U.M.Grassano, M.Meucci, A.Scacco.
Rev. Phys. Appl. (France), vol.18, no.5, p.301-6 (May 1983).
The description of two home-built colour centre lasers is presented. Technical details of the solutions are given with special concern to the production of the F_A(II) centres in KCl:Li crystals. The fluorescence properties of these centres are briefly investigated and an example of application to molecular spectroscopy is shown. (29 refs.)

66286 **Selective pulsed pumping of the active elements of a powerful neodymium laser.** N.G.Basov, N.E.Bykovskii, V.V.Ivanov, V.I.Kozlovskii, A.S.Nasibov, Yu.V.Senatskii, G.V.Sklizkov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.47-52 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.54-9 (1982).
Considers the possibility of selective pumping of the active elements of a powerful neodymium laser by the radiation of semiconducting structures excited by short electron pulses. (11 refs.)

Generation of a series of narrow-band huge pulses in a laser with an electrooptical shutter .... See Entry 66303

Analysis of mode locking by synchronous pumping of a gain medium with long decay time .... See Entry 66304

The influence of growth conditions on strains in YAG crystals .... See Entry 66917

Nonlinear far-infrared magnetoabsorption and optically detected magnetoimpurity effect in n-GaAs .... See Entry 68179

Generation of stimulated emission in a concentrated barium-erbium double-fluoride crystal .... See Entry 68268

The experimental and theoretical investigation of the hot hole population inversion and far IR radiation generation in p-Ge under $E \perp B$ fields .... See Entry 68269

Population inversion and far IR emission of hot holes in Ge in crossed electric and magnetic fields .... See Entry 68270

Spectroscopic and laser properties of (Pr, La)P_5O_{14} and (Pr, Y)P_5O_{14} crystals .... See Entry 68300

Extremely uniform GaAs-AlGaAs heterostructure layers with high optical quality by molecular beam epitaxy .... See Entry 68445

42.55T Free electron lasers

66287 **Free-electron lasers and their applications.** P.Dobiasch (Max-Planck-Inst. fur Quantenoptik, Garching, Germany), K.L.Hohla, P.Meystre.
Opt. & Lasers Eng. (GB), vol.4, no.2, p.91-119 (1983).
Reviews the classical theory of the free-electron laser and discusses possible applications in laser fusion, laser-induced chemistry, biochemistry, and solid-state physics. The possibility of using optical wigglers to reach the VUV and soft X-ray regimes is also analysed. (25 refs.)

66288 **Model of the Cerenkov laser.** J.Soln (Harry Diamond Labs., US Army Electronics Res. & Dev. Command, Adelphi, MD, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2036-40 (April 1983).
A model of the (wigglerless) Cerenkov laser through the S matrix approach is given. Here the classical electron current due to electrons with straight trajectories interacts with a quantized radiation field in a refractive medium of finite extent. The multiphoton distribution function gives the mean photon multiplicity which in turn yields the gain at a given frequency. The imposition of the quantum recoil yields the full 'quantum mechanical' gain from which the usual 'classical' gain follows. In an example where the radiation wavelength is 2.5 mm and the refractive index 1.8, estimate the maximum gain to be about 20%; this suggests that the Cerenkov laser may be an effective radiation source. The effect of the finite interaction time of the gain calculation and a new, possible quantum, effect of residual photons are also discussed. (8 refs.)

66289 **Highly nonlinear theory of the free electron (Compton) laser. Exact equations.** V.A.Zhurakhovskiy.
Radio Eng. & Electron. Phys. (USA), vol.27, no.5, p.108-13 (May 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.5, p.965-71 (May 1982). [received: April 1983]
A specialized system of differential equations of state is formulated for the relativistic electrons of a provisionally rectilinear beam, subject to the resonant action of a group of transverse elliptically polarized high-intensity waves in the presence of a supplementary longitudinal electromagnetic field. This system is an exact physical model of a multiwave magnetically focused free electron (Compton) laser under large-signal conditions. The entire variety of resonances for such a device are analyzed qualitatively, and it is shown, ultimately, that a large frequency conversion coefficient and a high efficiency are alternative regimes. (18 refs.)

66290 **Highly nonlinear theory of the free-electron (Compton) laser. Average equations.** V.A.Zhurakhovskiy.
Radio Eng. & Electron. Phys. (USA), vol.27, no.5, p.114-19 (May 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.5, p.972-8 (May 1982). [received: April 1983]
A smoothed system of differential equations of state of the relativistic electrons of a provisionally rectilinear beam, underlying the resonance action of a group of transverse elliptically polarized high-intensity waves in the presence of an additional longitudinal electromagnetic field, is obtained in a second approximation of the averaging method for several rapidly rotating phases, extended to an abnormally large range of variation of the independent variable of the order of the inverse square of the small parameter. This system is an adequate mathematical model of a multiwave magnetically focused free-electron (Compton) laser in large-signal modes of operation. (2 refs.)

Parametric interaction and backward wave oscillation in stimulated Compton scattering .... See Entry 66331

42.60 LASER SYSTEMS AND LASER BEAM APPLICATIONS

66291 **Measurement of laser beam divergence.** J.Falk (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Appl. Opt. (USA), vol.22, no.8, p.1131-2 (15 April 1983).
Demonstrates a simple technique that can determine beam divergence for even a single shot of a pulsed laser. The divergence determined is the far-field divergence even if the measurement is made in the laser's near field. Divergence is recorded by propagating the laser beam through a birefringent crystal placed between a polarizer-analyzer pair. The input polarizer is set to pass light polarized at ~45° to the crystal's ordinary axis so that light propagates with approximately equal amplitudes of ordinary and extraordinary polarizations. (10 refs.)

66292 **Heat load limits in laser mirrors with a cooled porous backing.** V.V.Kharitonov, A.A.Plakseev (Moscow Engng. Phys. Inst., Moscow, USSR).
High Temp. (USA), vol.20, no.4, p.594-9 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.712-17 (July-Aug. 1982). [received: April 1983]
A simple model is proposed for the analysis of the thermal state of laser mirrors with porous cooling. The maximum possible heat fluxes that can be removed in the porous structure without boiling of the coolant are estimated. It is shown that for water flowing at high velocity through a finely dispersed porous medium the heat fluxes removed can be well in excess of 10 MW/m^2. (4 refs.)

Experimental investigation of the characteristics of a planar surface discharge .... See Entry 66774

42.60B Design of specific laser systems

66293 **Demonstration of multilevel multichannel optical frequency shift keying (FSK) with cleaved-coupled-cavity (C^3) semiconductor lasers.** W.T.Tsang, N.A.Olsson, R.A.Logan (Bell Labs., Murray Hill, NJ, USA), R.A.Linke.
Electron. Lett. (GB), vol.19, no.9, p.341-3 (28 April 1983).
Reports the first demonstration of multilevel multichannel (4-level, 2-channel) optical frequency shift keying (FSK) using a newly developed cleaved-coupled-cavity (C^3) GaInAsP semconductor laser operating at ~1.3 μm. This is made possible because of the very large frequency tuning rate (~10 Å/mA) and frequency tuning range (~150 Å) achievable with these new lasers. In addition, such a laser is also shown to operate in a highly stable single-longitudinal model even under high-speed direct frequency modulation. (6 refs.)

66294 **Manufacturing the laser tube [for measurement system].** R.H.Grote (Hewlett-Packard Co., Palo Alto, CA, USA).
Hewlett-Packard J. (USA), vol.34, no.4, p.17-18 (April 1983).
Describes the manufacture of a He-Ne laser for Hewlett-Packard's HP 5528A Laser Measurement System. It is shown how careful design of the manufacturing process was used to control the quality of this product. (no refs.)

66295 **Mechanical design features of the laser head.** C.R.Steinmetz (Hewlett-Packard Co., Palo Alto, CA, USA).
Hewlett-Packard J. (USA), vol.34, no.4, p.19-20 (April 1983).
Describes the design of mechanical parts for the laser head of Hewlett-Packard's HP 5528A Laser Measurement System. Emphasis was on low-cost parts for most components and fabrication processes were selected with this in mind. Another major consideration was easy replacement and repair in the field. (no refs.)

66296 **A quadruple transmission line nitrogen laser.** P.Persephonis, B.Giannetas, R.Rigopoulos (Lab. de Phys. II, Univ. de Patras, Patras, Greece).
Rev. Phys. Appl. (France), vol.18, no.5, p.295-300 (May 1983).
Theoretical considerations on the advantages of a quadruple parallel-plate transmission line nitrogen laser comparatively to a double transmission line one are given. Experimental verification shows that from a double line N_2 laser to a quadruple one, an increase of the peak power and energy per pulse about 50% and 70% respectively exists. A common spark-gap is used. Experimental curves show the peak power increase versus pressure and repetition rate. The quadruple transmission line can be used in any other TE N_2 laser and other discharge gas lasers. (20 refs.)

66297 The application of 'organometallic' technology to the growth of GaAs/GaAlAs laser structures. M.Baldy, S.D.Hersee, P.Assenat (Lab. Central de Recherches, Thomson-CSF, Orsay, France).
Rev. Tech. Thomson-CSF (France), vol.15, no.1, p.5-37 (March 1983). In French.
Describes the means used to optimize the technique of organometallic growth of GaAs/GaAlAs lasers emitting at a wavelength of 0.85 μm. It is shown that it is possible to obtain good laser structures in reproducible fashion and with satisfactory uniformity. Furthermore, using a new structure (the 'GRIN SCH'), it proved possible to achieve the lowest threshold current density ever reported for a semiconductor laser -121 A cm^{-2} for a 1800 μm-long chip. (11 refs.)

66298 Carbon dioxide laser with sequential transitions and a composite resonator. V.P.Avtonomov, V.N.Bel'tyugov, A.A.Kuznetsov, V.N.Ochkin, N.N.Sobolev, M.V.Spiridonov, Yu.V.Troitskii, Yu.B.Udalov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1400-2 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2155-9 (Nov. 1982). [received: May 1983]
An analysis is made of the problem of selection of sequential transitions ($00^0\nu_3 \rightarrow [10^0\nu_3\text{-}1, 02^0\nu_3\text{-}1]$) in CO_2 lasers. A new method is proposed in which sequential transitions are selected using a composite resonator formed by a diffraction grating and a diffraction reflecting interferometer. In contrast to a CO_2 laser with a heated cell, the use of a composite resonator makes it possible to construct a more compact sequential CO_2 laser and to ensure rapid switching of lasing between the main and sequential transitions. Measurements are reported of the gain for the main and sequential transitions and of the populations of the CO_2 molecular levels. (13 refs.)

66299 Characteristics of a pulsed chemical laser utilizing an H_2-F_2 mixture and initiated by radiation from an XeCl excimer laser. E.B.Gordon, V.I.Matyushenko, V.D.Sizov.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1420-4 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2186-92 (Nov. 1982). [received: May 1983]
A study was made of the influence of the active mixture composition on the energy and temporal characteristics of an HF laser, for various diluents (He, Kr, Xe, N_2, SF_6). An efficiency of 1500%, measured relative to the ultraviolet initiation energy deposited in the mixture, was achieved utilizing an $F_2{:}O_2{:}H_2{:}SF_6=7.5{:}0.75{:}2.5{:}3.5$ mixture at $p=110$ Torr. The specific output energy increased in proportion both to the initiation energy (i.e. keeping the efficiency constant) and to the concentration of the fuel mixture (for a given initiation energy). An output energy of 38 J/liter was achieved for an $F_2{:}O_2{:}H_2{:}SF_6=25{:}2.5{:}2.5{:}20$ mixture ($p=0.5$ atm) with a concentration of atoms created by the ultraviolet radiation of $[F]_0 \sim 2\times10^{16}\ \mathrm{cm}^{-3}$. (9 refs.)

66300 Investigation of CW operation of a GaAs laser pumped by an electron beam. V.I.Kozlovskii, A.S.Nasibov, P.V.Reznikov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1437-40 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2211-16 (Nov. 1982). [received: May 1983]
An experimental investigation was made of the dependences of the power and threshold characteristic of an electron-beam-pumped CW GaAs laser on the concentration and nature of the dopant, thickness of the semiconductor plate, reflection coefficient of the mirrors, diameter of the electron beam, and cryostat temperature. An output power of 20 mW was recorded and the output radiation was found to have a divergence of less than 10° and a spectral width not exceeding 1 nm. (9 refs.)

Heavy ion beam pumped He-Ar laser ....See Entry 66254

Phase-locked (GaAl)As laser emitting 1.5 W CW per mirror ...See Entry 66271

Twin-channel substrate-mesa-guide injection lasers fabricated by organometallic vapor phase epitaxy ....See Entry 66272

Photopumped low threshold $Al_{x''}Ga_{1-x''}As$-$Al_{x'}Ga_{1-x'}As$-$Al_xGa_{1-x}As$ ($x''\sim0.85$, $4ix'\sim0.3$, $x=0$) single quantum well lasers ....See Entry 66273

A decisive state for laser diodes ....See Entry 66278

Selective pulsed pumping of the active elements of a powerful neodymium laser ....See Entry 66286

High-speed direct single-frequency modulation with large tuning rate and frequency excursion in cleaved-coupled-cavity semiconductor lasers ....See Entry 66302

42.60D Laser resonators and cavities

66301 Influence of Lorentz broadening on the stability of monomode ring lasers. P.Mandel (Service de Chim. Phys., Univ. Libre de Bruxelles, Bruxelles, Belgium).
Opt. Commun. (Netherlands), vol.45, no.4, p.269-72 (15 April 1983).
The author carries out a linear stability analysis of the stationary solutions describing in the frame of the semiclassical theory a Lorentz broadened single running mode in a ring laser. The author looks for the conditions of destabilisation via a Hopf bifurcation and proves that it can occur only in a bad cavity. The threshold intensity is very high when homogeneous broadening dominates, it is of the order of a few saturation intensities when homogeneous and inhomogeneous widths are comparable and it tends to zero as the inhomogeneous width increases well beyond the homogeneous width. (6 refs.)

Gas laser with a phase anisotropy in an axial magnetic field for arbitrary relative excitation of the active medium ....See Entry 66251

Natural fluctuations in a multimode standing-wave laser ....See Entry 66252

Photon conservation in flashlamp pumped dye lasers ....See Entry 66267

Chirp in picosecond film lasers and pulse compression by linear dispersion in optical fibers ....See Entry 66280

Carbon dioxide laser with sequential transitions and a composite resonator ....See Entry 66298

High-speed direct single-frequency modulation with large tuning rate and frequency excursion in cleaved-coupled-cavity semiconductor lasers ....See Entry 66302

Analysis of mode locking by synchronous pumping of a gain medium with long decay time ....See Entry 66304

Gas-lens effect and cavity design of some frequency-stabilized He-Ne lasers ....See Entry 66305

Significance of intra-cavity power density in synchronous mode-locking of CW-dye lasers ....See Entry 66311

Diffraction splitting of frequencies in a ring laser with a misaligned quadratically homogeneous active element ....See Entry 66315

Optical bistable circuits ....See Entry 66326

Intracavity generation of second harmonics and sum frequencies in $LiIO_3$ crystal in an infrared He-Ne laser ....See Entry 66335

Generation of continuous-wave radiation near 243 nm by sum-frequency mixing in an external ring cavity ....See Entry 66338

Intracavity second harmonic excitation under the action of an external signal on a Q-switched solid-state ring laser ....See Entry 66342

Magneto-optical bistable device ....See Entry 66373

42.60F Laser beam modulation

66302 High-speed direct single-frequency modulation with large tuning rate and frequency excursion in cleaved-coupled-cavity semiconductor lasers. W.T.Tsang, N.A.Olsson, R.A.Logan (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.650-2 (15 April 1983).
The authors report a new mechanism of direct frequency modulation, the cavity-mode enhanced frequency modulation (CME-FM), using the newly developed cleaved-coupled-cavity (C^3) semiconductor laser. In this operation, one of the diode of the C^3 laser was operated as a laser, while the other diode was operated as a frequency modulator. It was shown that a very large frequency excursion of 150 Å and frequency tuning rate of 10 Å/mA have been obtained with a C^3 GaInAsP crescent laser operating at 1.3 μm. Time-resolved spectral and spectral-resolved pulse response measurements also showed that such C^3 lasers operated in highly stable single-longitudinal mode at all times even under high-speed direct frequency modulation. In addition to the important application as the optical source in FM optical communication systems, the present CME-FM C^3 laser can also be used as the optical source in wavelength-division multiplexing systems. Further, it opens the possibility of ultrahigh capacity multilevel optical FM information transmission systems. (16 refs.)

66303 Generation of a series of narrow-band huge pulses in a laser with an electrooptical shutter. A.V.Agashkov, Yu.F.Morgun.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.763-8 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.42-8 (July 1982). [received: March 1983]
The possibility of the generation of a series of narrow-band huge pulses in a neodymium laser is demonstrated. An electrooptical shutter with photoelectric control was used to modulate the Q-factor of the laser. (12 refs.)

66304 Analysis of mode locking by synchronous pumping of a gain medium with long decay time. Z.A.Yasa (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
Opt. Lett. (USA), vol.8, no.5, p.277-9 (May 1983).
Analytical expressions are given to describe the pulse characteristics and the mode-locking regime for the synchronously pumped laser with a radiative lifetime≥cavity round-trip time. (6 refs.)

FIR NH_3 cascade laser excited by a Q-switch laser ....See Entry 66258

Demonstration of multilevel multichannel optical frequency shift keying (FSK) with cleaved-coupled-cavity (C^3) semiconductor lasers ....See Entry 66293

Gas-lens effect and cavity design of some frequency-stabilized He-Ne lasers ....See Entry 66305

42.60H Optical problems related to properties and interactions of laser beams

66305 Gas-lens effect and cavity design of some frequency-stabilized He-Ne lasers. P.Cerez (Lab. de l'Horloge Atomique, Univ. de Paris-Sud, Orsay, France), R.Felder.
Appl. Opt. (USA), vol.22, no.8, p.1251-6 (15 April 1983).
It is shown that there exists an optical cavity length which should minimize the frequency shifts induced by lenslike effects in intracavity saturated absorption lasers. Ideas are developed which provide a satisfactory explanation for the dispersion in modulation shifts observed in some recent laser intercomparisons. (19 refs.)

66306 Amplification and measurement of single 1.6-3.5 ps pulses generated by a distributed feedback dye laser. G.Szabo, Z.Bor (Dept. of Experimental Phys., Jozsef Attila Tudomanyegyetem Univ., Szeged, Hungary), A.Muller.
Appl. Phys. B (Germany), vol.B31, no.1, p.1-4 (May 1983).
The authors have shown that distributed feedback dye lasers are capable of generating single transform-limited pulses of 1.6-3.5 ps duration when pumped by a mode-locked Nd:YAG laser. A short-pulse amplifier has been constructed in which the level of amplified spontaneous emission could be kept below 10^{-3} by properly taking into account the polarization anisotropy of the gain and by precise timing of the pump pulses. A sensitive autocorrelator is also described which allows one to measure pulse duration in a single shot. (16 refs.)

66307 Comparison between the $^{127}I_2$ stabilized He-Ne lasers at 633 nm and 612 nm of the BIPM and the IMGC. F.Bertinetto (Istituto di Metrologia G. Colonnetti, Torino, Italy), P.Cordiale, G.B.Picotto, J.-M.Chartier, R.Felder, M.G.Glaser.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.72-6 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
In November 1981, a comparison between BIPM ('Bureau International des Poids et Mesures') and IMGC ('Istituto di Metrologia G. Colonnetti') He-Ne lasers stabilized to saturated absorption lines of $^{127}I_2$, at the wavelengths $\lambda=633$ nm, and $\lambda=612$ nm has been made at the BIPM. At 633 nm, a repeatability and a reproducibility within $+1\times10^{-11}.\nu$ have been obtained. At 612 nm, a repeatability within a few $10^{-11}.\nu$ only for one laser and a reproducibility of $\pm2\times10^{-10}.\nu$ have been obtained. (10 refs.)

66308 International intercomparison of laser power measurements in the visible region. M.Endo, T.Honda (Electrotech. Lab., Sakuramura, Ibaraki, Japan).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.77-81 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
Describes results of the international intercomparison of He-Ne and Ar-ion laser power measurements. The intercomparison measurements were of He-Ne laser power of 3 mW at the wavelength of 633 nm and Ar-ion laser power of 200 mW at 488 nm and 515 nm. The participating laboratories coincided within deviation from the average of 0.6 percent at 633 nm, 0.8 percent at 488 nm, and 0.9 percent at 515 nm. (3 refs.)

66309 Results of international comparisons using methane-stabilized He-Ne lasers at 3.39 μm and iodine-stabilized He-Ne lasers at 633 nm. J.-M.Chartier (Bur. Internat. des Poids et Mesures, Sevres, France).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.81-3 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
The results of international comparisons of methane-stabilized He-Ne lasers at $\lambda=3.39$ μm and iodine-stabilized He-Ne lasers at 633 nm, made by heat frequency techniques, between Bureau International des Poids et Mesures (BIPM) and eleven national laboratories are presented. Generally, the measured frequency differences were inside $\pm 4\times 10^{-11}$; but greater frequency differences were observed with some iodine cells (probably as a result of contamination) or when the output power of one laser was two or three times greater than the power of the other laser. (20 refs.)

66310 Dye laser spectrum narrowing by 'double pulse' flashlamp pumping. M.N.Nenchev, A.Y.Gisbrekht (Inst. of Electronics, Bulgarian Acad. of Sci., Sofia, Bulgaria).
Opt. Commun. (Netherlands), vol.45, no.4, p.266-8 (15 April 1983).
A novel simmple 'two-step lasing' technique for flashlamp dye laser spectrum narrowing is proposed. The laser spectrum is locked by double pulse pumping at the preliminary narrowed prepulse emission. As an example the waveguide flashlamp pumped dye laser is discussed. (18 refs.)

66311 Significance of intra-cavity power density in synchronous mode-locking of CW-dye lasers. J.Kluge, D.Wiechert, D.von der Linde (Univ. Gesamthochschule-Essen, Essen, Germany).
Opt. Commun. (Netherlands), vol.45, no.4, p.278-80 (15 April 1983).
It is shown that there is a well-defined relation between the intra-cavity power density and the temporal structure of ultrashort light pulses generated by a synchronously pumped CW dye laser. To obtain pulses of good quality with high output power the beam cross-section in the lasing medium must be large, because the best performance is achieved at low power density. (10 refs.)

66312 Laser fluctuation studies in intensity dependent absorption of light. V.Harwalkar, H.Bohidar, S.Chopra (Phys. Dept., Indian Inst. of Technol., New Delhi, India).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.241-5 (May 1983).
The interaction of a laser with an intensity-dependent absorber has been analysed for discrete regions of operations of the laser. It is shown that the beam is thermally defocused due to absorption for the values of intensity under consideration. The fluctuation properties have been analysed by evaluating $\langle I\rangle$, $\langle I^2\rangle$ and $\langle(\Delta I)^2\rangle/\langle I\rangle^2$. (9 refs.)

66313 Estimation of the minimum laser linewidth achievable with a grazing-grating configuration. E.Armandillo (CNEN, Casaccia, Italy), G.Guiliani.
Opt. Lett. (USA), vol.8, no.5, p.274-6 (May 1983).
The influence of beam divergence on second-order grating dispersion terms is found and discussed. It is shown that divergence in the plane normal to the plane of incidence sets the lowest limit of the achievable linewidth. By using a double-grating configuration to achieve both spectral narrowing and tuning, one can obtain a laser linewidth down to ≈0.01 Å in a discharge-pumped XeF laser. (12 refs.)

66314 Modal analysis of separate-confinement heterojunction lasers with inhomogeneous cladding layers. W.Striefer, R.D.Burnham, D.R.Scifres (Xerox Palo Alto Res. Centers, Palo Alto, CA, USA).
Opt. Lett. (USA), vol.8, no.5, p.283-5 (May 1983).
Separate-confinement heterostructure lasers with thin active regions are analyzed. For four different interior-cladding-region refractive-index spatial variations, i.e. step, triangular, parabolic, and inverted parabolic, waveguide modes are calculated and thresholds are compared. Based on optical considerations alone, the step-index profile has the lowest threshold; however, for optimum cladding thicknesses the differences are not great. (14 refs.)

66315 Diffraction splitting of frequencies in a ring laser with a misaligned quadratically homogeneous active element. A.Ya.Birman, A.F.Savushkin, V.A.Solomatin, E.N.Tropkin.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1465-9 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2256-64 (Nov. 1982). [received: May 1983]
The diffraction splitting of frequencies of the opposite waves in a ring laser with a quadratically inhomogeneous active element is calculated for the case of weak diffraction. The dependences of the frequency splitting on the mode index, length of the active element, and its position along the resonator axis are determined. A study is made of the influence of misalignment of a quadratically inhomogeneous active element on the diffraction effects in ring lasers with resonators containing even and odd numbers of mirrors. (14 refs.)

Sidebands in cooperative resonance fluorescence in collections of N three-level atoms in strong excitation laser fields .... See Entry 66246

Runaway self-absorption in multikilowatt CO_2 lasers .... See Entry 66253

Effects of optical irregularities in the active medium on angular divergence of a beam in a CW supersonic DF-CO_2 chemical laser .... See Entry 66263

Chirp in picosecond film lasers and pulse compression by linear dispersion in optical fibers .... See Entry 66280

Carbon dioxide laser with sequential transitions and a composite resonator .... See Entry 66298

Investigation of CW operation of a GaAs laser pumped by an electron beam .... See Entry 66300

Propagation in media with Raman-type nonlinearity: polarization states of the waves and gains .... See Entry 66336

Actively coupled index-guided lasers .... See Entry 66388

42.60K Optical problems related to applications of laser beams

66316 Regularizing the solution of the laser sounding equation of atmospheric aerosols by means of a stabilizing functional. S.I.Kavkyanov, N.N.Momerov, V.I.Tsanev (Inst. of Electronics, Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.35, no.12, p.1661-3 (1982). (4 refs.)

66317 Laser optical components for machine tool and other calibrations. R.R.Baldwin, L.E.Truhe, D.C.Woodruff (Hewlett-Packard Co., Palo Alto, CA, USA).
Hewlett-Packard J. (USA), vol.34, no.4, p.14-16, 18, 20-2 (April 1983).
Describes optical components to be used with Hewlett-Packard's HP 5528A Laser Measurement System for calibrating machine tools and other things. Included are: the linear interferometer; angular optics; the straightness interferometer; the post, height adjuster and base for optics positioning; a levelling plate mount for the turning mirror; a straightness accessory kit; optical square; flatness mirror; tripod-to-laser adaptor plate. Computer modelling of the system is also described. (2 refs.)

66318 The accuracy of distance measurements with laser pulse. E.Popescu, N.D.Grosu, Gh.Stoenescu, L.Teodorescu (Inst. de Fizica si Tehnologia Aparatelor cu Radiatii, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.9, p.871-85 (1982). In Rumanian.
Describes the properties of pulsed laser range-finders, which are affected by the receiver pulse shape. The effect of atmospheric scintillation on the accuracy of an optical pulsed range-finder as well as on the probability of its detection is examined. This analysis has been made assuming that photoemission of the detectors is described by Poisson statistics. The decrease in the strength of returned pulse, the distortion and the time delay of the electrical pulse after photoelectric conversion, and the resolution of the time interval counter, as well as the fluctuation of the atmospheric index of refraction can be limitation factors of the accuracy of optical pulsed measurements. Methods for improving measurement accuracy are discussed. (18 refs.)

66319 Optimal regime for forming topological patterns when processing films with laser radiation. V.P.Veiko, I.M.Karpman, M.N.Libenson, E.B.Yakovlev (Inst. of Precision Mech. & Optics, Leningrad, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1408-11 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2167-72 (Nov. 1982). [received: May 1983]
The results are given of an experimental investigation of the physical and technological laws governing the formation of individual precision components in thin films, and of the synthesis of these pattern components using the contour-projection method. A study was made of the influence on the quality of the synthesized pattern of the degree of overlapping of the neighboring components. The results of the experiments were used to establish the fundamental limitations of this method. A method is proposed for selecting the optimal processing regime. (9 refs.)

A new microcomputer-controlled laser dimensional measurement and analysis system .... See Entry 64878

Automatic compensation [for laser beam measurement system] .... See Entry 64879

Long path length samples in thermal lens calorimetry .... See Entry 64905

Observation of a photoionic image in a laser desorption microscope .... See Entry 64951

Inverse Lamb dip spectroscopy using microwave modulation sidebands of CO_2 laser lines .... See Entry 64966

Uses of laser optical pumping to produce polarized ion beams .... See Entry 65772

Free-electron lasers and their applications .... See Entry 66287

Reading and writing of photochemical holes using GaAlAs-diode lasers .... See Entry 66323

Boresighting collimators using laser unequal path interferometry .... See Entry 66375

Matching of single-mode optical waveguides to semiconductor lasers .... See Entry 66406

A new type of laser probe .... See Entry 66431

Spectroscopic Doppler-free methods for measuring the electric and magnetic fiels in magnetically insulated ion diodes .... See Entry 66758

Spatially resolved temperature measurements in a flame using laser-excited two-line automatic fluorescence and diode-array detection .... See Entry 68778

Lidar system for visibility monitoring .... See Entry 69384

42.65 NONLINEAR OPTICS

66320 Nonlinear optical coupling between radiation and confined modes. G.M.Carter, Y.J.Chen (GTE Labs. Inc., Waltham, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.643-5 (15 April 1983).
Equations are developed which describe the coupling between radiation and confined (guided wave or surface plasmon) modes in the presence of an intensity-dependent index of refraction. Solutions are presented for three numerical examples and comparisons are made with asymptotic solutions. The authors find that under certain conditions, the addition of the nonlinear index drastically alters the coupling and gives rise to the possibility of optical switching. Experimental parameters for optimizing such switching are discussed. (11 refs.)

66321 Blocking oscillation of optical bistable devices using DC drift phenomena of $LiNbO_3$ waveguide. J.Yumoto, H.Yajima, S.Ishihara, Y.Sekiguchi, K.Yamaya (Electrotech. Lab., Ibaraki, Japan), M.Nakajima.
Appl. Phys. Lett. (USA), vol.42, no.9, p.780-2 (1 May 1983).
Graphical solutions and experimental results of the blocking oscillation of the guided-wave optical bistable devices using DC drift phenomena of $LinbO_3$ are reported. The frequency of the oscillation can be varied in the range from 0.1 to 100 Hz by changing bias voltage and input light level. (8 refs.)

66322 Two-photon optical multistability theory. Li Fu-li (Dept. of Phys., Univ. of Sci. & Technol. of China, Hefei, China).
Acta Phys. Sin. (China), vol.32, no.1, p.71-83 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The theory of the optical multistability by two-photon resonant interaction is investigated. The nonlinear medium inside a Fabry-Perot cavity is in two-photon resonance with the laser beam. The two-photon equation of state including dynamical Stark shift and relaxation parameters is obtained and studied under mean-field approximation. The equations for both Fabry-Perot cavity and ring cavity take basically the same form. The physics mechanisms resulting in optical multistability are also studied. It has been shown that the combined effects of Kerr switching and saturation absorption switching can lead to two-photon optical double-bistability, tristability as well as bistability. Furthermore, the criterion conditions under which double-bistability or tristability can occur are given and discussed. Finally, the phase-conjugated reflectivity by two-photon four-wave mixing is also shown to exhibit multistability as well as hysteresis. (9 refs.)

66323 Reading and writing of photochemical holes using GaAlAs-diode lasers. P.Pokrowsky, W.E.Moerner, F.Chu, G.C.Bjorklund (IBM Res. Lab., San Jose, CA, USA).
Opt. Lett. (USA), vol.8, no.5, p.280-2 (May 1983).
A current-tuned GaAlAs-diode laser is utilized both to burn and to detect narrow photochemical holes in the inhomogeneously broadened 833-nm zero-phonon line of the R' color center in LiF. Applications for reading and writing data into frequency-domain optical memories based on photochemical hole burning are discussed. (10 refs.)

66324 Optically bistable switching of a semiconductor resonator with a 30 ps pulse. S.D.Smith, C.T.Seaton, M.E.Prise, W.J.Firth, F.Tooley, C.R.Pidgeon (Phys. Dept., Heriot-Watt Univ., Edinburgh, Scotland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.413-15 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors report the bistable switching of a 200 μm thick InSb Fabry-Perot resonator, using a single 30 ps switched-out pulse from a Nd:YAG mode-locked laser. The device has been made to act as an 'optical memory', and, by splitting and delaying one part of the pulse, as an optical AND gate. (5 refs.)

66325 Optical bistability observed in amorphous semiconductor films. J.Hajto, I.Janossy (Central Res. Inst. for Phys., Budapest, Hungary).
Philos. Mag. B (GB), vol.47, no.4, p.347-66 (April 1983).
The optical properties of amorphous self-supporting $GeSe_2$ films show strong non-linear behaviour under the influence of relatively low-intensity CW laser irradiation. Discontinuities, bistability and, in special circumstances, oscillation in the optical properties have been found. The importance of thermal effects is experimentally proved. A theoretical model is constructed which explains some of the experimental findings. Evidence is presented, however, that, as well as thermal effects, photostructural changes also play an important role in the bistability and oscillatory phenomena. (19 refs.)

66326 Optical bistable circuits. F.Hoff.
Slaboproudy Obz. (Czechoslovakia), vol.44, no.3, p.145-7 (March 1983). In Czech.
Typical characteristics of optical bistable systems (OBS) are presented. The operation of a dispersive Fabry-Perot resonator is examined and the principle of a hybrid OBS system with an electrooptical crystal placed in the Fabry-Perot resonator is examined. OBS systems without an electrooptical feedback which require the use of nonlinear optical material are then dealt with. The principles of two types of nonlinearity—reactive and absorption—are discussed. Applications of OBS as switching devices for fully optical circuits are considered. (1 ref.) *E.D.*

66327 Optical radiation filtration with nondegenerate four-photon interaction. V.V.Ivakhnik (Kuibyshev State Univ., Kuibyshev, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.765-7 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.97-9 (Aug. 1982). [received: April 1983]
The effects of frequency shift between incident and reflected waves, conversion efficiency, and positive feedback coefficient on quality of wave-front rotation are studied for the nondegenerate four-photon interaction. (6 refs.)

Comprehensive theory for line broadening in high-resolution and nonlinear spectroscopies: application to the Na D lines .... See Entry 65924

Real-time edge enhancement in four-wave mixing with photorefractive BGO crystals .... See Entry 66228

Semiclassical many-mode Floquet theory .... See Entry 66244

Laser fluctuation studies in intensity dependent absorption of light .... See Entry 66312

Scattering of light by an intense saturating pulse in a resonance medium .... See Entry 66672

Electron-hole-pair generation and hysteresis in semiconductors .... See Entry 67644

Absorption of picosecond light pulses by CdTe single crystals .... See Entry 68155

Nonlinear far-infrared magnetoabsorption and optically detected magnetoimpurity effect in *n*-GaAs .... See Entry 68179

42.65B General theory

66328 Boundary-value problems in nonlinear optics of resonant media. V.I.Rupasov, V.I.Yudson (Inst. of Spectroscopy, Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1415-19 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2179-86 (Nov. 1982). [received: May 1983]
A study is made of the problem of transmission of light pulses by a boundary of a nonlinear medium under conditions of coherent interaction with matter. It is shown that in the case of a semiinfinite nonlinear medium the reflection coefficient is governed by the linear characteristics of the media in contact so that the boundary-value problem reduces to the Cauchy problem. In another case, when a nonlinear medium is a thin film at the interface between two linear media, it is found that such a film is an almost perfect mirror reflecting weak pulses but it becomes transparent to pulses of sufficiently high intensity and the mirror then modulates the amplitude of such pulses. (8 refs.)

42.65C Stimulated Raman, Brillouin and Rayleigh scattering; parametric oscillations and harmonic generation

66329 Application of the inverse scattering transform method to SBBS in an inhomogeneous medium: the Zakharov-Manakov solution. R.H.Enns (Dept. of Engng. Phys., Australian Nat. Univ., Canberra, Australia).
Can. J. Phys. (Canada), vol.61, no.4, p.604-11 (April 1983).
The inverse scattering transform method has been applied to the stimulated Brillouin backscattering (SBBS) interaction in a weakly spatially inhomogeneous medium. Specifically, the Zakharov-Manakov problem has been solved for examples of both an amplifier and a generator experimental setup yielding the complete spatial and temporal evolution of the light pulses involved. The structure of the resulting pulse shapes is discussed and the results compared with those in the literature. (15 refs.)

66330 Time oscillations of the amplification coefficient during induced Raman scattering of light in the polarised and non-polarised regime. F.N.Marchevskii, L.L.Strizhevskii, V.P.Feshchenko, Yu.V.Kholodenko.
Kvantovaya Elektron., Kiev (USSR), no.23, p.44-8 (1982). In Russian.
Theoretically investigates the possibility of an optical nutation effect developing during non-stationary Raman scattering of light at polaritons. The conditions under which the nutation effect causes time oscillations in the amplification coefficient are examined. The characteristic time dependence of the amplification coefficient for wave and frequency detuning is investigated. (9 refs.)

66331 Parametric interaction and backward wave oscillation in stimulated Compton scattering. A.Gover (Faculty of Engng., Tel-Aviv Univ., Tel-Aviv, Israel).
Opt. Commun. (Netherlands), vol.45, no.4, p.281-4 (15 April 1983).
Stimulated Compton-Raman scattering and free electron lasers are formulated as parametric (four-photon) or three-wave interaction processes. Manley-Rowe relations and depletable pump equations are derived for both free electron lasers and optical klystron schemes. A process of backward wave oscillation is predicted when a pump radiation field is back scattered off a codirectionally propagating e beam with frequency down conversion. A practicable experiment in the optical regime is proposed to demonstrate this effect. (15 refs.)

66332 Three-frequency Raman-amplification source (theory). N.E.Kornienko, A.M.Steba, V.L.Strizhevskii.
Opt. & Spectrosc. (USA), vol.53, no.3, p.336-7 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.568-9 (Sept. 1982). [received: May 1983]
Derives a theory for the steady-state generation and amplification of Stokes and anti-Stokes waves in gaseous media with Raman and parametric processes, saturation effects, and a possible difference between the Raman polarizabilities of the Stokes and anti-Stokes waves (χ_s and χ_a, respectively; the difference may be caused, particularly, by single-photon quasi-resonances or interacting waves). The authors assume that the pump wave and the Stokes wave ω_s (for the anti-Stokes waves ω_a) are applied to the entrance to the nonlinear medium [either inverted ($n<0$) or noninverted ($n>0$)]. (1 ref.)

66333 Effect of the spectral width of a two-photon pump on parametric frequency upconversion in metal vapor. A.V.Aleksandrov, S.A.Pleshanov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.337-9 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.570-2 (Sept. 1982). [received: May 1983]
The authors are interested in how the efficiency of the four-photon parametric frequency conversion of the signal ω_1 into the sum frequency $\omega_2=2\omega_p+\omega_1$ depends on the spectral width of the two-photon pump ω_p. To obtain theoretical estimates in the case of a broadband pump the authors use an averaging method based on successive approximations in terms of small parameters. (6 refs.)

66334 Line shape of anti-Stokes stimulated Raman scattering in organic dye solutions. V.I.Petrov, Ya.S.Bobovich.
Opt. & Spectrosc. (USA), vol.53, no.3, p.342-3 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.577-9 (Sept. 1982). [received: May 1983]
Using a solution of the polymethine dye 3,3′-diethylthiatricarbo-cyaniniodide (DTTC) in dimethylformamide (DMF), the authors demonstrate that the interference mechanism is important in shaping the resonant stimulated Raman scattering (RSRS) lines even in the case of different secondary emission centres. The interference of these two processes for light conversion is, therefore, a rather general property of molecules in an intense coherent light field. (7 refs.)

66335 Intracavity generation of second harmonics and sum frequencies in $LiIO_3$ crystal in an infrared He-Ne laser. F.Kaczmarek, A.Jendrzejczak (Quantum Electronics Lab., A. Mickiewicz Univ., Poznan, Poland).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.187-91 (May 1983).
Several second harmonics and sum frequencies were generated in a phase-matched $LiIO_3$ crystal placed within an optical cavity of a high-power He-Ne infrared laser operated at 1.15 μm. (12 refs.)

66336 Propagation in media with Raman-type nonlinearity: polarization states of the waves and gains. G.Rivoire, C.Deslancs, J.L.Ferrier, J.Gazengel, N.Phu Xuan (Lab. d'Optique des Fluides, Angers, France).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.209-16 (May 1983).
The simultaneous propagation of laser and Raman waves through nonlinear media is theoretically studied using the nonlinear third-order susceptibility tensor formalism. Polarization states and gains with linearly, circularly and elliptically exciting polarizations are calculated. The theoretical expressions are compared with experimental results in the absence of self focusing. The perturbations due to self focusing near the stimulated Raman scattering thresholds are studied and conclusions concerning the anisotropy of the Kerr constant are obtained. (12 refs.)

66337 Squeezed states in second-harmonic generation. L.A.Lugiato, G.Strini (Istituto di Fisica, Milano, Italy), F.De Martini.
Opt. Lett. (USA), vol.8, no.5, p.256-8 (May 1983).
The authors consider the process of second-harmonic generation with the nonlinear crystal placed in a resonant cavity. Both the fundamental and the second-harmonic mode are shown to exhibit squeezing. An analysis is made for general values of the ratio between the damping constants of the two modes. The authors suggest that second-harmonic generation is the most suitable system to use for an experimental observation of the squeezing effect. (14 refs.)

66338 Generation of continuous-wave radiation near 243 nm by sum-frequency mixing in an external ring cavity. B.Couilalaud, L.A.Bloomfield, T.W.Hansch (Dept. of Phys., Stanford Univ., Stanford, CA, USA).
Opt. Lett. (USA), vol.8, no.5, p.259-61 (May 1983).
The authors have generated up to 1 mW of single-mode CW ultraviolet radiation between 243 and 247 nm by mixing the outputs of an ultraviolet argon-ion laser at 363.8 nm and a red LD700 dye laser in ammonium dihydrogen phosphate. The dye-laser intensity within the crystal is enhanced by using an actively locked passive ring cavity. Wavelengths near 243.1 nm are of particular interest for the high-resolution two-photon spectroscopy of atomic hydrogen. (6 refs.)

66339 Nonlinear generation of the guided mode in an anisotropic thin-film optical waveguide. E.Weinert-Raczka (Inst. of Phys., Tech. Univ. of Szczecin, Szczecin, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.195-203 (1982).
Describes nonlinear generation of the guided mode utilizing phase matching among the two radiation modes of frequencies ω_1 and ω_2 and the guided mode generated of the frequency $\omega_3=\omega_1-\omega_2$. The situation described is restricted to weak harmonic generation, the pump power depletion being neglected. (9 refs.)

66340 Non-local aspects of second harmonic generation at a metal surface. P.Apell (Dept. of Phys., Univ. of Pennsylvania, Philadelphia, PA, USA).
Phys. Scr. (Sweden), vol.27, no.3, p.211-16 (March 1983).
A general non-local expression for the second harmonic generated current in a metal is derived within an explicit spatially dependent quadratic response formalism. In the limit of an instantaneous response earlier hydrodynamical results are corroborated. Surface sensitivity and spatial extension of the induced current are discussed. Gauge invariance is used to express the second harmonic current only of the electric and magnetic fields instead of the gauge-dependent potentials A and θ. (37 refs.)

66341 Investigation of electronic stimulated Raman scattering of excimer laser radiation by metal atoms. V.S.Verkhovskii, V.M.Klimkin, V.E.Prokop'ev, V.F.Tarasenko, V.G.Sokovikov, A.I.Fedorov (Inst. of Atmospheric Optics, Acad. of Sci., Tomsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1397-400 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2151-5 (Nov. 1982). [received: May 1983]
An experimental investigation was made of stimulated Raman scattering (STRS) of excimer laser radiation in barium, thulium, and europium vapors. The energy of XeF* laser radiation (λ=351 nm) converted to the yellow range (585 nm) in barium vapor was 6 mJ and the conversion efficiency was ~39%. The spectral composition of the converted radiation is governed by the STRS, by four-wave parametric processes, and also by lasing due to the natural barium transition. Selection of the pump frequencies is required to concentrate the converted radiation at a single frequency and to reduce its divergence. Stimulated Raman scattering of XeCl* laser radiation (λ=308 nm) was achieved in thulium vapor at λ=422 nm. In europium vapor in quasiresonance with the $6s^2\ {}^8S_{1/2}{}^0$-$5d^2\ {}^{10}P_{11/2}{}^0$ forbidden transition, stimulated emission was obtained due to the natural $5d^2\ {}^{10}P_{11/2}{}^0$-$6s6p\ {}^{10}P_{11/2}$ and $5d^2\ {}^{10}P_{11/2}{}^0$-$6s6p\ {}^{10}P_{3/2}$ transitions. (9 refs.)

66342 Intracavity second harmonic excitation under the action of an external signal on a Q-switched solid-state ring laser. G.V.Krivoshchekov, V.I.Samarin (Inst. of Automation & Electrometry, Acad. of Sci., Novosibirsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1440-3 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2216-20 (Nov. 1982). [received: May 1983]
A theoretical analysis is made of the energy parameters of the second harmonic under conditions of intracavity excitation in a *Q*-switched ring laser. It is shown that the proposed laser system is potentially useful under the action of an external signal which ensures unidirectional extraction of the harmonic. (10 refs.)

Resonant multiphoton ionisation and third-harmonic generation in mercury vapour ....See Entry 65937

Influence of nonlinear frequency mixing on multiphoton ionization of gases ....See Entry 66667

Instantaneous Ramanography of a turbulent diffusion flame ... See Entry 68779

An optimized device for UF_6 laser isotopic photochemistry using an optical parametric oscillator and a down converter ....See Entry 68787

42.65F Phase conjugation

66343 Comments on Shakir's 'zero-area optical pulse processing by degenerate four-wave mixing'. B.R.Suydam, R.A.Fisher (Univ. of California, Los Alamos Nat. Lab., Los Alamos, NM, USA).
Opt. Commun. (Netherlands), vol.45, no.4, p.285-7 (15 April 1983).
The authors disagree with one of the contentions of Shakir's paper (see ibid., vol.40, p.151, 1981), namely that a zero-area pulse can be generated by an unstable phase conjugator. The authors find, on the contrary, that any unstable conjugator would, if the pumps were not depleted, generate a conjugate wave of infinite area. The authors show by counterexample that the response generated by Shakir's technique is noncausal if the conjugator is unstable. (4 refs.)

66344 Study of dynamical effect using phase conjugation of light waves. M.I.Stockmann (Inst. of Automation Electrometry, Siberian Branch of the USSR Acad. of Sci., Novosibirsk, USSR).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.430-3 (4 April 1983).
New effects are predicted which appear at the phase conjugation of a light wave transmitted through a dynamical optical system (nonstationary medium). The theory of these effects is developed and their relation with the dynamical form factor of the system is established. The predicted effects may be used as a basis of a new optical method for studying fast processes in matter which does not require either short light pulses or fast photodetectors. (9 refs.)

Holography, coherent light amplification and optical phase conjugation with photorefractive materials ....See Entry 66240

Level crossing effect in degenerate four-wave mixing ....See Entry 66345

42.65G Photon echoes, self-induced transparency, optical saturation and related effects

66345 Level crossing effect in degenerate four-wave mixing. Fu Pangming, Mi Xin (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.1, p.133-8 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Third-order nonlinear susceptibility $\chi^{(3)}$ $(-\omega;\ \omega,\ \omega,\ -\omega)$ is calculated in nearly-degenerate quasi-two-level system by perturbation method. The authors have studied the level crossing effect in degenerate four-wave mixing and compared it with the level crossing effect in resonance fluorescence. The possibility of using level crossing effect in degenerate four-wave mixing to measure the relaxation rate of upper and lower state is pointed out. (8 refs.)

66346 Current state of experimental studies of resonance media by the photon-echo method. V.V.Samartsev (Kazan Physicotech. Inst., Acad. of Sci., Kazan, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.524-37 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.100-12 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Examines the phenomenon of photon echo and its applications. Particular attention is devoted to the current state of experimental studies of resonant media (mostly activated crystals) by this and other optical transition phenomena with characteristic time constants τ_e that are smaller than or comparable with the longitudinal (T_1) and irreversible transverse (T_2) relaxation times. In addition to the photon echo, these phenomena include free induction, self-induced transparency, and nutation. The analogs of some of these phenomena are well-known in radio-frequency spectroscopy, where they have been found to be very promising from the standpoint of spectroscopic and technological applications. (74 refs.)

66347 Coherent phenomena during the interaction between light pulses and resonance media. E.A.Manykin, S.O.Elyutin, S.M.Zakharov, V.N.Likhachev, A.I.Maimistov (Moscow Engng. Phys. Inst., Moscow, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.538-56 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.113-29 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The study of coherent processes occurring during the interaction between ultrashort light pulses and resonant media is now an extensive and rapidly advancing branch of nonlinear optics. The problems surveyed by the authors constitute only a part of this branch of physics. The phenomenon of the photon echo of complex shape, coherent processes during two-photon resonance, and the derivation of rigorous analytic results by the inverse scattering method have a relatively short history but now form an independent field of study. Progress has been achieved in this area as a result of the systematic inclusion of inhomogeneous broadening and nonlinear propagation effects in the analysis of the evolution of ultrashort pulses in the medium, both in space and in time. (87 refs.)

66348 Light echo in gases. A.I.Alekseev, A.M.Basharov (Moscow Engng. Phys. Inst., Moscow, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.557-73 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.130-44 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Discusses echo spectrometry in gaseous media, concentrating attention on those investigations that have been generally accepted or advanced promising proposals. Photon echo is the spontaneous coherent emission by atoms after the excitation of a resonant medium by a sequence of two or more exciting pulses of light. The photon echo in gases is often found to have a different appearance as compared with solids. This is connected with the thermal motion of the atoms, the degeneracy of the energy levels, and atomic collisions. The use of the photon echo in gaseous media appears to be particularly promising. The authors demonstrate the advantages of using the photon echo in nonlinear laser spectroscopy. (56 refs.)

66349 Light-induced gratings of coherent superposition states of atoms. E.I.Shtyrkov (Kazan Physicotech. Inst., Kazan, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.579-85 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.149-54 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
It is possible to induce spatial gratings by electromagnetic fields that are separated in time by an interval much greater than their duration, which essentially excludes direct interference between these fields. The formation of gratings in a resonant medium under such conditions is among the so-called transient quantum phenomena because it is based on the interference between coherent atomic superposition states produced in such a way that an ensemble of atoms that has been subjected to coherent and resonant excitation has a phase memory for the excitation coherence. The different properties of transients such as nutation, photon echo, coherent transmission, and scattering of light, and so on in relation to the direction and time of appearance of coherent responses are due to the properties of the dynamic spatial gratings of coherent states which modulate all the parameters of the medium. (18 refs.)

66350 Two-photon self-induced transparency and diffraction phenomena. V.D.Gora, A.P.Sukhorukov, T.Shlegel (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.593-9 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.162-7 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Reports the results of a numerical study of self-induced transparency (SIT) under the conditions of two-photon resonance. The authors studied the space-time evolution of light packets and have found the conditions for coherent self-focusing that must be satisfied by the beam width, the pulse length, the detuning from resonance, and the pulse area on the beam axis. They have also investigated the dynamic stark effect as well as the self-focusing and the defocusing of short light pulses under adiabatic conditions. (22 refs.)

66351 Reversed photon echo in ruby. V.A.Zuikov, V.V.Samartsev, R.G.Usmanov (Kazan Physicotech. Inst., Kazan, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.600-3 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.168-71 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Reports an investigation of a new optical coherent response, namely, the reversed photon echo (RPE) which substantially extends spectroscopic and technological applications of the photon echo technique. The medium under investigation was ruby (${}^4A_2$-${}^2E(\bar{E})$ transition) with chromium ion concentration of 0.05 wt.%. The measurements were performed at 2.2K. (14 refs.)

66352 Light-beam scanning and coherent transient processes. R.A.Vlasov, E.V.Doktorov, V.S.Kuz'min (Inst. of Phys., Acad. of Sci., USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.604-8 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.172-6 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The examples of self-induced transparency (SIT) and photon echo are used to examine coherent transient processes produced with scanned beams. In addition to translational scanning, the authors also examine conical scanning and analyze possible applications of the latter in studies of the narrowing of lines broadened by dipole-dipole interactions. (10 refs.)

66353 Self-induced transparency with the participation of excitons and biexcitons in semiconductors. S.A.Moskalenko, P.I.Khadzhi, A.Kh.Rotaru, E.S.Kiseleva (Inst. of Appl. Phys., Acad. of Sci., Moldavian SSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.609-13 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.177-81 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Notes some of the features of nonlinear coherent interaction between light and excitons. The starting point for the theoretical analysis of self-induced transparency (SIT) in the exciton part of the spectrum is the set of nonlinear equations for the amplitude *a* of the exciton wave and the wave equation for the vector potential A^+. From the equations for the envelopes, the authors deduce, by introducing additional physical conditions, the shape of the field and exciton pulses, the amplitude, the time distribution, the velocity and area of pulses, and also the dispersion relation for the carrier wave $\omega(k)$. These properties appear when only the exciton-exciton interaction is taken into account. (6 refs.)

66354 A classical model of the photon echo. V.P.Chebotayev, B.Ya.Dubetsky (Inst. of Thermophys., Acad. of Sci., Novosibirsk, USSR).
Appl. Phys. B (Germany), vol.B31, no.1, p.45-52 (May 1983).
An observation and the theory of a nonlinear response in the ensemble of nonlinear classical oscillators excited by two field pulses—similar to the phenomenon of a photon echo in optics—are reported. It has been shown that an echo arises in any ensemble with an inhomogeneously broadened line regardless of the type of interaction with a field (classical or quantum). New peculiarities appear during the determinate distribution of frequencies in the ensemble. On the one hand, an echo pulse is observed with a relatively small (about 100) number of oscillators N, on the other, new pulses spaced at a distance that is proportional to N arise in the nonlinear response. (4 refs.)

66355 Experimental test of the optical Bloch equations for solids. R.G.DeVoe, R.G.Brewer (IBM Res. Lab., San Jose, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1269-72 (25 April 1983).
This paper provides the first experimental test of the Bloch equations for an optical transition in a low-temperature impurity-ion solid, $Pr^{3+}:LaF_3$, where the condition $T_1 \gg T_2$ applies. Intensity-dependent optical free-induction-decay measurements are performed by use of an ultrastable CW dye laser (linewidth, 300 Hz) and reveal an $\exp(-2T/T_2)$ decay law at low Rabi frequency (χ), as predicted by the Bloch equations, and an $\exp(-\chi t)$ decay at high χ, which violates the Bloch prediction but agrees with Redfield's characterization (1955) of NMR saturation in solids. (16 refs.)

66356 Optical bleaching in tellurium. L.S.Dubinskaya, A.D.Galetskaya, I.I.Farbshtein (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1536-41 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2709-18 (Sept. 1982). [received: April 1983]
Optical bleaching in tellurium was investigated at 20 and 90K near the fundamental absorption edge, which is subject to the Urbach rule if pumping in by a helium-neon laser. An approximate expression is obtained for bleaching with an interband transition, which gives a fairly accurate description of both the amount of bleaching and the dependences of the effect on frequency, temperature, and sample thickness. Analysis of the results leads to the conclusion that the Urbach blurring of the absorption edge is due to static defects of the dislocation type. Estimates are made of the surface and bulk recombination velocities of nonequilibrium carriers in tellurium with quadratic recombination. (19 refs.)

66357 Theory of the self-induced transparency of surface and waveguide solutions. V.M.Agranovich, V.I.Rupasov, V.Ya.Chernyak (Inst. of Spectroscopy, Acad. of Sci., Troitsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1693-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2992-9 (Oct. 1982). [received: April 1983]
A theory of the self-induced transparency of surface electromagnetic waves and waveguide solutions which are in resonance with oscillations is developed for a transition layer. The transition layer is described using a model of a two-dimensional gas of two-level systems. A surface (waveguide) soliton solution [surface (waveguide) 2π pulse] is obtained and the dependences of the duration of such a soliton pulse on the permittivities of the media in contact and on the properties of the transition layer are discussed. The polarization of a transition layer normal to the interface is considered. The behavior of a surface soliton under the conditions when the surface density of two-level systems in a transition layer varies along the interface of the two media is studied. (5 refs.)

Polarization spectroscopy of gaseous media by the photon-echo method .... See Entry 64957

Inverse Lamb dip spectroscopy using microwave modulation sidebands of CO_2 laser lines .... See Entry 64966

Coumarin 6 as the active medium of a dye vapor laser with wide-band optical pumping and specific characteristics of such lasers .... See Entry 66269

Gas-lens effect and cavity design of some frequency-stabilized He-Ne lasers .... See Entry 66305

Time oscillations of the amplification coefficient during induced Raman scattering of light in the polarised and non-polarised regime .... See Entry 66330

Three-frequency Raman-amplification source (theory) .... See Entry 66332

Investigation of coherent emission in time-separated fields .... See Entry 66673

42.65J Beam trapping, self focusing, thermal blooming, and related effects

Propagation in media with Raman-type nonlinearity: polarization states of the waves and gains .... See Entry 66336

Two-photon self-induced transparency and diffraction phenomena .... See Entry 66350

42.70 OPTICAL MATERIALS

66358 Anti-reflection coatings for electro-optic elements made out of KH_2PO_4, GaAs and CdTe crystals. I.E.Kacher, Yu.Yu.Firtsak, N.I.Dovgoshei.
Kvantovaya Elektron., Kiev (USSR), no.23, p.101-4 (1982). In Russian.
The authors have developed two-layer antireflection coatings based on the chalcogenide films Ge-As(Sb)-S(Se) and the fluorides CaF_2, MgF_2, BaF_2 and PbF_2 for electro-optic elements used in the near-IR. The best combinations of coatings are chosen and the reflection spectra of the coated elements are calculated. The proposed coatings have high chemical stability and optical strength. (12 refs.)

Rutherford backscattering evidence for solid phase laser annealing of Corning 7059 glass and ZnO thinfilsm .... See Entry 66359

Proposal of electro-optical switching and memory devices utilizing doping and undoping processes of conducting polymers .... See Entry 66371

Index instabilities in proton-exchanged $LiNbO_3$ waveguides .... See Entry 66381

A comparative study of the dopant profiles in diffused planar optical waveguides by SIMS and guided wave probe .... See Entry 66382

Surface recombination velocity in a silicon optical waveguide .... See Entry 66383

Epon 828 epoxy: a new photoelastic-model material .... See Entry 66530

Hard carbon coatings with low optical absorption .... See Entry 68340

Experimental study of the temperature distributions in white sapphire single crystals .... See Entry 68422

Stick-on cobalt oxide selective coatings for solar thermal applications .... See Entry 68435

Transparent conducting layers, their preparation and utilisation .... See Entry 68446

42.70C Glass

66359 Rutherford backscattering evidence for solid phase laser annealing of Corning 7059 glass and ZnO thinfilsm. S.Dutta, H.E.Jackson (Dept. of Phys., Univ. of Cincinnati, Cincinnati, OH, USA), J.T.Boyd, C.W.White.
J. Appl. Phys. (USA), vol.54, no.4, p.2125-6 (April 1983).
Rutherford backscattering meaurements have been made on ZnO and Corning 7059 glass optical waveguides before and after laser annealing to investigate whether melting is associated with the dramatic improvement in scattering loss which occurs after laser annealing. These measurements indicate that no redistribution of impurities takes place during annealing. The authors conclude that no melting occurs and that the annealing occurs in the solid phase. (5 refs.)

66360 Chalcogenide glasses—promising materials for quantum electronics. I. Interaction and structure of glasses in the As-S system. V.V.Khiminets.
Kvantovaya Elektron., Kiev (USSR), no.23, p.64-80 (1982). In Russian.
Systematically classifies a large amount of work on interaction and glassification in the As-S system. The structure of glassy and crystalline compounds and alloys which are promising for use in quantum electronic devices and optical information processing is discussed. (55 refs.)

66361 Detection of platinum atoms in optical glasses by a light scattering method. S.Gebala (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland), J.Sarzynski.
Opt. Appl. (Poland), vol.12, no.2, p.257-60 (1982).
Pt^0 in glass evokes an increased absorption within the whole visible range, which causes the glass to grow grey. This effect follows from the light scattering and depends on the sizes and concentrations of the molecules. Pt^0 is a good nucleator and easily creates heterogeneous dispersive colloidal particles responsible for the scattering of light. Under these circumstances the authors deal with the colloidal scattering and colloidal change in glass colour. The measurement results of the light transmission, the scattered light intensity and the coefficient of the polarized scattered light for the glasses melted in ceramic and platinum crucibles are presented. The results have been obtained by using comparative methods. To prepare the glasses for examination a part of the glass melted in ceramic was next remelted in a platinum crucible and then both parts were annealed. (5 refs.)

Calculation of refractive indices using Buchdahl's chromatic coordinate .... See Entry 66204

A comparative study of the dopant profiles in diffused planar optical waveguides by SIMS and guided wave probe .... See Entry 66382

Decreased losses in germanium-oxide glass optical fiber prepared by VAD method .... See Entry 66393

Increasing the numerical aperture of a glass-polymer light guide .... See Entry 66403

42.70G Light-sensitive materials

The diffraction efficiency of holographic gratings made out of the photosensitive system As_2Se_3-As_2S_3-Ag .... See Entry 66238

42.72 OPTICAL SOURCES AND STANDARDS

(for spectroscopic light sources, see also 07.65)

Concerning the polarisation of radiation from electroluminescent films of ZnS-Mn in a Fabry-Perot resonator .... See Entry 68330

42.78 OPTICAL LENS AND MIRROR SYSTEMS

(for microscopes, see 07.60P; for photographic instruments, see 07.68; for astronomical telescopes, see 95.55)

66362 Future lenses for 16-mm cinematograph projectors. K.D.Sharma (Instrument Design Dev. Centre, Indian Inst. of Technol., New Delhi, India).
Appl. Opt. (USA), vol.22, no.8, p.1188-91 (15 April 1983).
Designs of two-lens systems for use as 16-mm cinematograph projector objectives have been developed at a focal length of 50 mm and relative apertures of $f/1.4$ and $f/1.2$, respectively. The 50-mm $f/1.4$ system is comprised of five elements, and the 50-mm $f/1.2$ system is comprised of six elements. The proposed designs are not based on any known configuration, but their forms are arrived at from a hybrid approach combining the good points of some of the better known systems. The proposed systems are capable of giving extremely good performance, which has not been possible so far in the lenses of the same complexity in current use. (4 refs.)

66363 Evaluation of wave aberrations of objectives. III. Analysis of lateral shearing interferograms. Experimental results. B.Dubik (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.151-63 (1982).
For pt.II see ibid., vol.11, no.3, p.425-30 (1981). A setup to test the objective is presented in which lateral shearing interferograms are produced. The method for analysis of the obtained interferograms as well as the block scheme of the programme calculating the objective wave aberrations are given. The experimental and numerical results are presented in tables and graphs. (5 refs.)

66364 Chromatic aberration of a system of holographic lenses produced on non-plane surfaces. A.Kijek (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.173-8 (1982).
The dependence determining the chromatic aberrations of a system of an arbitrary number of holographic lenses produced on the rotationally symmetric surfaces of second degree has been derived. A method of designing an achromatic system of holographic lenses is presented. (5 refs.)

66365 Numerical analysis of the aberration for selected examples of holographic lenses on non-plane substrates. A.Kijek (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.179-87 (1982).
The applicability of the formulae describing the coefficients of third order aberration in analysis of aberration values is shown for chosen examples of holographic lenses produced on non-plane substrates. The influence of particular parameters of the holographic system on the real value of aberration is

shown. The relation describing the sphero-chromatic aberration is derived and its exemplified values calculated. (6 refs.)

66366 Testing the quality of the operating surface of a parabolic devitrified glass astronomical mirror. D.T.Puryaev, V.A.Gorshkov, O.N.Fomin, V.G.Lysenko.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.475-8 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.7-9 (Aug. 1982). [received: April 1983]
A method is described for certifying a 2.6-m diameter parabolic devitrified glass mirror in a vertical testing scheme by means of an IKAP-2 interferometer having a universal compensator in the measuring arm. The vertical testing scheme is given along with the schematic of the interferometer, an interferogram and topographical map of the operating surface of the mirror. (4 refs.)

66367 Calculation of Fresnel optical lens elements. Yu.K.Vifanskii.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.490-3 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.19-23 (Aug. 1982). [received: April 1983]
A method is presented for calculating the construction parameters of Fresnel optical lens elements, which determine their basic optical characteristics, for an arbitrary position of the source and its image with respect to the optical axis of the system and an arbitrary inclination of the element to the optical axis. The lens elements are calculated for viewing instrument. The optical characteristics of the instrument having such lens elements match the calculation data. A three-dimensional space perception is achieved when viewing is done with two eyes. (5 refs.)

66368 Universal measuring tube for testing telescope systems. M.A.Ostrovskaya, O.A.Pronina.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.496-9 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.25-8 (Aug. 1982). [received: April 1983]
The construction of the IFK-7 measuring tube, designed for measuring the optical characteristics and geometrical aberrations of telescopic systems and also for evaluating the quality of the image produced by these systems, is described. A method is given for calculating the components of the optical system of a measuring tube having improved optical characteristics. (2 refs.)

66369 A monocular camera based measurement system using the thin lens approximation. M.E.Hinkey, R.M.Inigo (School of Engng. & Appl. Sci., Univ. of Virginia, Charlottesville, VA, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.180-4
The growing industrial trend towards automation requires reliable and accurate measurement processes. The use of a monocular TV camera system and the thin lens approximation is an alternative to be considered for some applications. This paper shows one simple implementation of this approach to two-dimensional measurement. (7 refs.)

66370 Specification and tolerancing of reflective test systems for IR and visible use. D.A.Byrd, J.H.Ward.
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.185
Summary form only given, as follows. The increased use of infrared lasers, thermal imaging systems and infrared instrumentation has renewed interest in simple reflective systems. This paper describes four such systems: a) spherical collimators; b) parabolic collimators; c) Dall-Kirkham telescopes; d) Schwartzchild microscope objectives. Reflective systems have found use in a variety of test and alignment, system integration, boresight, resolution, MTF and MRTD measurements, and laser beam divergence and power measurements. Reflective components offer several advantages. They can be accurately tested and aligned with visible light insuring good performance throughout the near and mid infrared wavelength region. They have good transmission over wide band widths; and large apertures often exceeding 12 inches are practical. The main disadvantage is field of view. This restriction can be worked with by understanding the limitations of each type of system. The authors discuss the geometric limitations of each class of systems, comparing them to each other as well as to the ideal theoretically diffraction limited system. Applications of each type are described. The effect of random surface errors is related to system image spot size. Optical surface tolerances are illustrated by examples of interferograms, spot sizes and system specifications. (no refs.)

Measurement of long radius of curvature .... See Entry 64882

General Gaussian theory of mechanically compensated zoom lenses. III. Critical point and singular point of the zoom equation .... See Entry 64980

Gaussian beam ray-equivalent modeling and optical design ...... See Entry 66202

Omnidirectional viewing: the fish-eye lens problem .... See Entry 66233

Heat load limits in laser mirrors with a cooled porous backing .... See Entry 66292

Laser optical components for machine tool and other calibrations .... See Entry 66317

Radiant energy transmission along hollow-lens lightguides ...... See Entry 66386

Geodesic lens of rotational symmetry with axis parallel to light propagation direction .... See Entry 66411

Interferometric countercheck in precision cementing .... See Entry 66412

Self-calibrating surface measuring machine .... See Entry 66414

Modelling and simulation of a field of heliostats reflecting direct solar radiation onto a fixed target .... See Entry 68855

Selectively absorbing glasses for the potential prevention of ocular disorders .... See Entry 69030

42.80 OPTICAL DEVICES, TECHNIQUES AND APPLICATIONS

(for optical instruments and techniques, see 07.60; for optical spectroscopy, see 07.65; for photography, see 07.68; for holography, see 42.40; for lasers, see 42.55 and 42.60; for masers, see 42.52)

66371 Proposal of electro-optical switching and memory devices utilizing doping and undoping processes of conducting polymers. K.Yoshino, K.Kaneto, Y.Inuishi (Faculty of Engng., Osaka Univ., Suita, Osaka, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L157-8 (March 1983).
New optical switching and memory elements utilizing the spectral change of conducting polymers by electrochemical doping and undoping are proposed. (12 refs.)

66372 Use of focused light beams in schlieren instruments for studying randomly inhomogeneous media. M.B.Kashevnik, Yu.I.Kopilevich.
Opt. & Spectrosc. (USA), vol.53, no.3, p.314-17 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.535-40 (Sept. 1982). [received: May 1983]
The application of focused light beams in schlieren instruments with photoelectric recording used in studies of turbulent media is considered theoretically. The effect of wavefront curvature of the initial beam on the sensitivity and resolution of the instruments with different types of schlieren stops is analyzed. It is shown that the optimum selection of beam curvature can substantially improve the information potentials of the instruments with even transmission functions of the schlieren stops. (8 refs.)

66373 Magneto-optical bistable device. I.M.Popescu, A.G.Podoleanu, P.E.Sterian (Dept. de Phys., Inst. Polytech. de Bucarest, Bucarest, Rumania).
Rev. Phys. Appl. (France), vol.18, no.5, p.313-15 (May 1983). In French.
The authors present a mixed magneto-optical bistable device, realized in the active cavity of a laser by applying an axial magnetic field, the field being driven electronically by means of a feedback loop. (8 refs.)

66374 Background rejection in schlieren visualization. P.B.Nagy (Appl. Biophys. Lab., Tech. Univ. Budapest, Budapest, Hungary).
Ultrasonics (GB), vol.21, no.3, p.107-8 (May 1983).
It was recently suggested that an image orthicon could be used as a two-dimensional array of lock-in amplifiers. This technique enables rejection of extraneous optical signals from images of periodic phenomena, and the suitability of the method to improve schlieren images of ultrasonic beams is verified by experimental results. (7 refs.)

66375 Boresighting collimators using laser unequal path interferometry. R.B.Sartain (Martin Marietta Aerospace, Orlando, FL, USA), C.E.Halford, W.T.Smith, C.W.Bray.
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.169-73
A technique is presented for boresighting two separate collimators by using a laser unequal path interferometer. The analysis indicates that the accuracy of the technique approaches ten microradians with an approximate resolution of less than ten microradians. Experimental evidence is presented to support the analysis. (4 refs.)

Multiplier-type angle-measuring optical systems .... See Entry 64885

Optical profilometer in white light .... See Entry 64938

A study of geometrical factor in optical particle counters .... See Entry 64940

Refractive-index measurement of bulk materials: prism coupling method .... See Entry 64943

An optical probe for interface detection at high pressure (180 bar) and high temperature (360°C) [two-phase flow] .... See Entry 65562

Diffraction theory of the defocused-diaphram method .... See Entry 66208

Non-Gaussian image plane speckle: measurements from diffusers of known statistics .... See Entry 66220

Anti-reflection coatings for electro-optic elements made out of KH_2PO_4, GaAs and CdTe crystals .... See Entry 66358

Specification and tolerancing of reflective test systems for IR and visible use .... See Entry 66370

42.80B Spatial filters, zone plates

Colour image enhancement by white light spatial filtering ....See Entry 66225

42.80C Spectral and other filters

66376 Composite thin-foil bandpass filter for EUV astronomy: titanium-antimony-titanium. P.Jelinsky, C.Martin, R.Kimble, S.Bowyer (Space Sci. Lab., Univ. of California, Berkeley, CA, USA), G.Steele.
Appl. Opt. (USA), vol.22, no.8, p.1227-31 (15 April 1983).
Thin metallic foils of antimony and titanium have been investigated in an attempt to develop an EUV filter with a bandpass from 350 to 550 Å. A composite filter has been developed composed of antimony sandwiched between two titanium foils. The transmissions of sample composite foils and of pure titanium foils from 130 to 1216 Å are presented. The absorption coefficients of antimony and titanium and the effect of titanium oxide on the transmission are derived. The composite filter has been found to be quite stable and mechanically rugged. Among other uses, the filter shows substantial promise for EUV astronomy. (11 refs.)

Young's interference fringes with narrow-band light ....See Entry 66209

Selectively absorbing glasses for the potential prevention of ocular disorders .... See Entry 69030

42.80D Monochromators

Uniform and graded multilayers as X-ray optical elements ......See Entry 65001

42.80E Shutters, windows, diaphragms, deflectors, choppers

Diffraction theory of the defocused-diaphram method ....See Entry 66208

42.80F Gratings, echelles

66377 Discussion of the relative efficiency in the vacuum ultraviolet of diffraction gratings with laminar, sinusoidal, and triangular grooves. J.M.Lerner (Instruments SA Inc., Metuchen, NJ, USA), J.Flamand, A.Thevenon, M.Neviere.
Opt. Eng. (USA), vol.22, no.2, p.220-3 (March-April 1983).
A study was conducted using electromagnetic theory to determine the parameters necessary to optimize laminar groove gratings for use in the vacuum ultraviolet. This study predicted that the absolute efficiency of correctly optimized laminar and sinusoidal groove gratings should be about the same, and that triangular groove gratings should show higher efficiency. For the example calculated, it was shown that when compared to a triangular groove grating, laminar grooves should show far superior higher order attenuation at wavelengths around blaze and be better or equal up to about twice the blaze wavelength. From then on, the triangular profile is better. Actual results measured showed good correlation with predicted values. (8 refs.)

Multiplier-type angle-measuring optical systems .... See Entry 64885

Diffraction of light by a perfectly conducting biaxial periodic surface .... See Entry 66206

Diffraction of light by a bigrating: Surface polariton resonances and electric field enhancements .... See Entry 66211

Dynamic holograms on free carriers in semiconductors .... See Entry 66237

The diffraction efficiency of holographic gratings made out of the photosensitive system As_2Se_3-As_2S_3-Ag .... See Entry 66238

Estimation of the minimum laser linewidth achievable with a grazing-grating configuration .... See Entry 66313

Light-induced gratings of coherent superposition states of atoms .... See Entry 66349

Displacement measurements around cracks in three-dimensional problems by a hybrid experimental technique .... See Entry 66512

42.80K Optical beam modulators

66378 **Broadband guided-wave optical frequency translator using an electro-optical Bragg array.** R.H.Kingston, R.A.Becker, F.J.Leonberger (Lincoln Lab., MIT, Lexington, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.759-61 (1 May 1983).
The authors describe a new type of optical frequency translator which utilizes Bragg diffraction from a traveling index wave produced by an interdigitated electrode grating on a $LiNbO_3$ surface waveguide. The grating is driven by a three-phase electrical signal that results in a unidirectional wave with a fixed Bragg angle determined by the electrode spacing. The diffraction thus produces a single-sideband suppressed carrier optical output. Measurements at 10 and 100 MHz have yielded greater than 90% carrier-to-sideband conversion efficiency with over 100:1 suppression of the carrier and unwanted sideband. The device should be operable from arbitrarily low frequencies up to several gigahertz. (6 refs.)

66379 **Spatial light modulator.** H.Nishihara (Faculty of Engng., Osaka Univ., Osaka, Japan).
J. Inst. Telev. Eng. Jpn. (Japan), vol.36, no.12, p.1068-75 (Dec. 1982). In Japanese.
A light input type spatial modulator with ITC elements is described with an optical system structure, performance parameters, basic operation, BSO pockels readout and crystal and microchannel plate types. Electrical input type spatial light modulators are not yet available but digital types under development are reviewed. Some applications are treated including recording of holographic color video, real time correlative processing filtering (Mitsubishi and Sumitomo), projection display (GE,IMB) and image computation and processing using optical logic gates. (25 refs.)

66380 **Resolution and sensitivity of a spatial and temporal light modulator with an anisotropic electrooptic crystal.** V.B.Baglikov, V.V.Kolchin, O.N.Krasnopevtseva, T.V.Petrova.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1461-5 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2249-56 (Nov. 1982). [received: May 1983]
Calculations are reported of the solution and sensitivity of a spatial and temporal light modulator which is controlled optically with the aid of an anisotropic electrooptic crystal. The influence of a dielectric mirror is allowed for. It is shown that a calculation carried out using a simplified model employed in earlier work overestimates the results. The calculated data are compared with the experimentally determined modulator parameters. (8 refs.)

Demonstration of multilevel multichannel optical frequency shift keying (FSK) with cleaved-coupled-cavity (C^3) semiconductor lasers .... See Entry 66293

Phase modulation of coherent light in long multimode fiber light guides .... See Entry 66404

Phase modulation efficiency of coherent light in fiber light guides .... See Entry 66405

Light-controlled transparencies for storing optical images .... See Entry 66407

Integrated optics: electrical fields control light .... See Entry 66410

Optical heterodyne measurement of vibration phase .... See Entry 66527

42.80L Optical waveguides

(for fibre optical waveguides, see 42.80M)

66381 **Index instabilities in proton-exchanged $LiNbO_3$ waveguides.** A.Yi-Yan (CNET, Bagneux, France).
Appl. Phys. Lett. (USA), vol.42, no.8, p.633-5 (15 April 1983).
Measured effective mode indices on a day to day basis reveal an oscillatory behavior which indicates that the index profile of proton-exchanged $LiNbO_3$ waveguides evolves as a function of time. It is suggested that the profile instability might be brought about by a continuous migration of protons within the thickness of the guiding layer. Some index profile modification may also be introduced during fabrication due to structural changes in the crystal as a function of exchange time. (4 refs.)

66382 **A comparative study of the dopant profiles in diffused planar optical waveguides by SIMS and guided wave probe.** R.A.Betts, C.W.Pitt, K.R.Riddle, L.M.Walpita (Dept. of Electronic & Electrical Engng., Univ. Coll. London, London, England).
Appl. Phys. A (Germany), vol.A31, no.1, p.29-35 (May 1983).
A technique has been developed for dopant concentration depth profiling using static Secondary Ion Mass Spectrometry (SIMS), and an ex-situ ion milling facility to produce 'tapers' through the region of interest of an optical waveguide sample. Results have been obtained for titanium-diffused optical waveguides in lithium niobate and for potassium and caesium ion-exchanged glass waveguides. The SIMS profiles have been compared with refractive index profiles in multimode structures. The refractive index profiles have been obtained from the waveguide mode spectra by a piecewise linear Wentzel-Kramers-Brillouin (WKB) method. The two profiles are in close agreement. Use of the SIMS technique for single-mode Ti:$LiNbO_3$ waveguides has revealed significant changes in the forms of the profiles, compared with deeper structures, and the authors suggest a mechanism to account for these changes. (22 refs.)

66383 **Surface recombination velocity in a silicon optical waveguide.** M.Willander (Phys. Dept., Royal Inst. of Technol., Stockholm, Sweden).
Appl. Phys. A (Germany), vol.A31, no.1, p.45-9 (May 1983).
Measurements of the varying infrared absorption by free carriers in a silicon waveguide during intermittent electron bombardment are used to study the surface recombination velocity s. The same values for s are obtained for heat-treated and untreated samples, which supports the theory that electron beam irradiation in itself has a dehydrating effect. Other experiments show that s is not dependent on the energy of the impinging electrons in the range 16-23 keV. Finally, the temperature dependence of s in gold-doped silicon is estimated. If s is written in the form $s=s_0(293/T)^x$, x is found to be 2.1 ± 0.2 in the temperature interval $261K\leq T\leq 309K$. (18 refs.)

66384 **Investigation of the photoelastic effect in titanium-diffused optical waveguides in lithium niobate.** L.M.Andrushko, V.A.Voznesenskii.
Kvantovaya Elektron., Kiev (USSR), no.23, p.98-100 (1982). In Russian.
X-ray diffraction is employed to investigate the waveguide layers in $LiNbO_3$ produced by Ti-diffusion. The lattice parameters of $LiNbO_3$ are determined and the change of refractive index due to the photoelastic effect is considered. The obtained refractive index is compared with that at the surface alloyed with Ti and it is concluded that the contribution of the photoelastic effect during the formation of a waveguide by diffusion reaches 50%. (7 refs.)

66385 **Phenomena of the transformation of light polarization in multimode lightguides.** A.M.Bykov, A.V.Volyar, M.E.Kondakov, L.M.Kuchikyan.
Opt. & Spectrosc. (USA), vol.53, no.3, p.304-7 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.517-21 (Sept. 1982). [received: May 1983]
The effect of the method of exciting a multimode cylindrical lightguide with a rectangular refractive-index profile in its cross section on the polarization of the transmitted light is treated both experimentally and theoretically. It is shown that when polarized light is transmitted multimode lightguides can complete with single-mode lightguides. (11 refs.)

66386 **Radiant energy transmission along hollow-lens lightguides.** B.M.Lavrinovich.
Opt. & Spectrosc. (USA), vol.53, no.3, p.324-6 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.550-3 (Sept. 1982). [received: May 1983]
In several situations it is necessary to transmit intense light beams over large distances with a low loss. This is an urgent problem, for example, in solar-energy engineering, for the transmission of light beams from concentrators. The serious optical loss, the weight, and the cost are preventing the adoption of lens lightguides for transmitting intense light fluxes. Hollow-lens lightguides hold promise for this application. Such lightguides consist of positive annular toric or polyhedral (e.g. rectangular) cylindrical lenses. The area of the aperture in the annular lens or in a frame is many times larger than the area of the annular lens or frame lens itself. Such lightguides can have a rather large cross section and a high transmission, since they combine the advantages of hollow lightguides (a long mean free path of the ray from one side of the channel to the opposite side) and lens lightguides (low losses in the lenses). (6 refs.)

66387 **Mode energy transformation between two connected multimode general square-law-index optical waveguides.** S.G.Krivoshlykov, N.I.Petrov, I.N.Sissakian (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.193-207 (May 1983).
A coherent states method is used to investigate the mode coupling coefficients in the most general butt-joint problem for two multimode general square-law-index optical waveguides, when two different waveguides with elliptical cross-sections are to be butt-jointed with axis displacement, tilt and some turning of symmetry axes with respect to each other. The explicit expressions for the mode coupling coefficients and recurrence relations for the mode overlap integrals are obtained; the sum rules for the mode coupling coefficients are formulated and a method of experimental data analysis is proposed for this general problem. The method of calculating mode coupling coefficients is proposed for the case of the butt-joint problem when the waveguide cross-sections are only partially overlapping and then it is used to investigate the influence of misalignment on mode power distribution and pulse dispersion in the second waveguide. The experimental data are compared and it is shown that the coupling coefficients obtained in square-law-index model can be used in dispersion calculations for α-profile fibres in the case when the value α is not far from the value $\alpha=2$. (20 refs.)

66388 **Actively coupled index-guided lasers.** K.A.Shore (Dept. of Electrical Engng. & Electronics, Univ. of Liverpool, Liverpool, England).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.247-52 (May 1983).
An opto-electronic device is described in which two index-guided semiconductor lasers are actively coupled by means of a control injection current. The behaviour of the device under differing conditions of optical injection is examined. It is shown to be possible to find light-sensitive and light-insensitive configurations for device operation. The control current can be used to tune the sensitivity of the device. (12 refs.)

66389 **Elastooptic effect in a bent slab waveguide.** H.Marciniak (Inst. of Phys., Tech. Univ. of Warsaw, Warsaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.165-72 (1982).
The elastic strain imposed on the slab waveguide by physical deformation is shown to have a significant influence on wave propagation. Due to the existing stress, the dielectric medium changes into an anisotropic biaxial one. As a result the bending loss in the slab waveguide is reduced. (7 refs.)

66390 **Polarisation transformations of electromagnetic waves in multimode belt light guides.** A.M.Bykov, A.V.Volyar, L.M.Kuchukyan.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.450-2 (March 1983). In Russian.
Presents a theoretical calculation of the polarisation characteristics of light transmitted through belt light guides with small losses due to depolarisation and using the Jones-Muller formalism. On the basis of these calculations, a computer was used to formulate properties of multimode belt light guides for the transmission of linearly polarised light. It is shown that the degree of depolarisation of such light guides is minimal during the orientation of an electric vector perpendicular to one of the transverse cross-sections of the guide. (9 refs.) *V.G.P.*

66391 **Determination of irregular waveguide parameters.** A.D.Avdeev, T.N.Sagaidak.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.102-4 (Feb. 1983). In Russian.
A method of determining the width, surface impedance and refractive index in the irregular waveguide from waveguide equation coefficients is suggested. (2 refs.)

Modal analysis of separate-confinement heterojunction lasers with inhomogeneous cladding layers .... See Entry 66314

Blocking oscillation of optical bistable devices using DC drift phenomena of $LiNbO_3$ waveguide .... See Entry 66321

Nonlinear generation of the guided mode in an anisotropic thin-film optical waveguide .... See Entry 66339

Theory of the self-induced transparency of surface and waveguide solutions .... See Entry 66357

Rutherford backscattering evidence for solid phase laser annealing of Corning 7059 glass and ZnO thinfilsm .... See Entry 66359

Broadband guided-wave optical frequency translator using an electro-optical Bragg array ....See Entry 66378

Matching of single-mode optical waveguides to semiconductor lasers ....See Entry 66406

Integrated optics wave front measurement sensor ....See Entry 66409

42.80M Fibre optics

66392 Chromatic dispersion measurements in single-mode fibers using picosecond InGaAsP injection lasers in the 1.2- to 1.5-μm spectral region. C.Lin, A.R.Tynes, A.Tomita, P.L.Liu, D.L.Philen (Bell Labs., Murray Hill, NJ, USA).
Bell Syst. Tech. J. (USA), vol.62, no.2, pt.1, p.457-62 (Feb. 1983).
Describes the use of picosecond InGaAsP injection lasers for measuring chromatic dispersion in single-mode fibers in the 1.2-to 1.5-μm spectral region. Injection lasers at various wavelengths and a single-mode fiber-to-fiber switch are used in the pulse delay and pulse-broadening measurements. The simplicity and the compactness make the setup useful for field measurements and quality control. (11 refs.)

66393 Decreased losses in germanium-oxide glass optical fiber prepared by VAD method. H.Takahashi, I.Sugimoto (Central Res. Lab., Furukawa Electric Co., Ltd., Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L139-40 (March 1983).
A thick-clad germanium-oxide glass optical fiber doped with antimony has been prepared by the vapor-phase axial deposition (VAD) method. Loss values of less than 5 dB/km around 2 μm and 23 dB/km at 2.4 μm have been achieved. (2 refs.)

66394 Single polarization optical fibers. T.Katsuyama, H.Matsumura (Central Res. Lab., Hitachi Ltd., Kokubunji, Japan).
Hitachi Rev. (Japan), vol.31, no.6, p.331-4 (Dec. 1982). [received: April 1983]
Low loss single mode fibers that maintain polarization well have been developed. An extinction ratio of less than -30 dB at 1 km and a loss of 0.8 dB/km at 1.5 μm were achieved by concentric circular germanosilicate core-clad fibers with borosilicate elliptical jackets. These fibers are applicable to transmission lines of future coherent optical communication systems and are desirable for applications to integrated optical waveguide devices, as well as for other applications that depend upon the interactions of polarized light, such as laser gyros. (5 refs.)

66395 Raman investigation of the effects of torsion on fused silica optical fibers. M.S.Hokmabadi, G.E.Walrafen (Dept. of Chem., Howard Univ., Washington, DC, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5273-4 (15 April 1983).
The application of reversible tensile stress (3.3 GPa) to a pure fused silica optical fiber has been found to produce a significant modification of the Raman spectrum. Other Raman changes due to irreversible uniaxial compaction (9 GPa), and reversible hydrostatic compression (1 GPa), were uncovered recently. The present work constitutes a continuation of such studies in which Raman changes due to reversible torsion on a fused silica optical fiber (at constant load) are described and compared to new Raman results from irreversibly compacted fused silica. (11 refs.)

66396 Determination of parameters of circular optical fibers with a step profile in refractive index. S.M.Chernov, K.K.Zhilik, G.N.Petrovskii.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.839-43 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.137-42 (July 1982). [received: March 1983]
A method is described for investigating fibres which allows the determination of all the parameters in a single technique. The method is based on the recording and processing of the distribution of light intensity scattered by a stepwise fibre in a scan with a narrow light beam across the fibre. (5 refs.)

66397 Dispersion of tubular modes propagating in multimode optical fibres. A.Barthelemy (Lab. d'Optique, UER des Sci., Limoges, France).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.225-30 (May 1983).
The author has already used interferometric techniques for measuring, first, the impulse response of optical fibres and also the different times of flight of modes of a multimode fibre. Apart from time of flight, the author's set-up provides the intramodal dispersion of each mode $(d^2\beta/d\omega^2)$. To demonstrate this, the author has measured the modal dispersion difference between two tubular modes that were selectively excited in a multimode graded index fibre. For comparison, a theoretical expression has also been derived, based on a ray optics approach. (6 refs.)

66398 Fiber-optic diaphragm-curvature pressure transducer. C.M.Lawson, V.J.Tekippe (Electronics Lab., Gould Res. Center, Rolling Meadows, IL, USA).
Opt. Lett. (USA), vol.8, no.5, p.286-8 (May 1983).
A novel fiber-optic sensor that determines pressure from diaphragm curvature is discussed. This sensing technique exhibits a high degree of sensitivity and linearity and is less susceptible to environmental perturbations than previous intensity-modulating techniques. Experimental results are presented for a miniature pressure transducer suitable for in vivo medical applications. (9 refs.)

66399 Extreme picosecond pulse narrowing by means of soliton effect in single-mode optical fibres. L.F.Mollenauer, R.H.Stolen, J.P.Gordon (Bell Labs., Holmdel, NJ, USA), W.J.Tomlinson.
Opt. Lett. (USA), vol.8, no.5, p.289-91 (May 1983).
The authors report the narrowing of pulses, initially 7 psec FWHM, to widths as small as 0.26 psec by various lengths, short relative to the soliton period, of single-mode, low-loss optical fiber. Since the $\sim$1.5-μm wavelength lies in the region of negative group-velocity dispersion $(\partial v_g/\partial\lambda<0)$, no auxiliary dispersive element was required to complete the narrowing. Optimum compression was obtained for peak-pulse input powers of several hundred watts, corresponding to relatively high $(N<10)$ soliton number. The authors show these results to be in at least semiquantitative agreement with prediction based on the nonlinear Schrodinger equation. (10 refs.)

66400 Influence of the fibre diameter on the stress birefringence in high-birefringence fibres. S.C.Rashleigh, M.J.Marrone (Naval Res. Lab., Washington, DC, USA).
Opt. Lett. (USA), vol.8, no.5, p.292-4 (May 1983).
The influence of the outer diameter of the constraining region on the stress-induced birefringence in high-birefringences fibers is investigated for three fibre structures. Generally, the outer diameter should be three times larger than the mean diameter of the stress-producing regions to ensure that the birefringence is close to maximum. (14 refs.)

66401 The normalized cutoff frequencies of optical fibers with a parabolic variation of dielectric constant of the core. G.I.Gordon.
Radio Eng. & Electron. Phys. (USA), vol.27, no.6, p.9-16 (June 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.6, p.1066-73 (June 1982). [received: May 1983]
An expression is derived which allows determination of the normalized cutoff frequencies of linearly polarized modes and computation of total number of guided characteristic modes in an optical fiber with a quadratic variation of the dielectric constant of the core. (11 refs.)

66402 Optical fibre diagnostics using the backscattering method. J.Kanka, J.Hora (CASAV, Praha, Czechoslovakia).
Slaboproudy Obz. (Czechoslovakia), vol.44, no.3, p.105-11 (March 1983).
The backscattering method is described and its application possibilities are discussed with regard to the diagnostics of multimode optical fibres. After the method is analyzed theoretically, special attention is paid to the influence of fibre diameter fluctuation on backscattering. Moreover the procedure is stated for separating optical attenuation from the fluctuation of parameters of the filament using experimental data. Finally corroborative experiments are used to illustrate the problems of measuring attenuation and investigating the axial homogeneity in optical fibres using the backscatter method. (16 refs.)

66403 Increasing the numerical aperture of a glass-polymer light guide. I.V.Aleksandrov, S.Ya.Fel'd, O.E.Shushpanov (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1352-4 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2198-201 (Nov. 1982). [received: May 1983]
A light guide of the glass-polymer type with a thermoplastic cladding is considered. It is shown that the numerical aperture can be increased and the operating temperature range enlarged by suitably selecting the thermomechanical properties of the materials and the dimensions of the light guide. Equations are derived for choosing the light guide parameters and a numerical simulation is presented which illustrates the effectiveness of the cladding in improving light guide performance. (5 refs.)

66404 Phase modulation of coherent light in long multimode fiber light guides. O.I.Kotov, V.Yu.Petrun'kin, S.L.Sokolova, V.N.Filippov (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1354-6 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2202-6 (Nov. 1982). [received: May 1983]
The properties of coherent light passing through a multimode light guide are studied. The spatial and amplitude characteristics of a modulation signal produced by the mechanical disturbance of the wave guide are studied using a piezoelectric ceramic transducer. The experimental findings are in qualitative agreement with calculations based on the equations of geometric optics. (7 refs.)

66405 Phase modulation efficiency of coherent light in fiber light guides. O.I.Kotov, V.Yu.Petrun'kin, V.N.Filippov (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1357-8 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2207-9 (Nov. 1982). [received: May 1983]
Phase modulation in multimode light guides is studied theoretically for different detection and signal processing schemes with allowance for the mode structure of the output light. The results are compared with those for a single-mode light guide. (6 refs.)

66406 Matching of single-mode optical waveguides to semiconductor lasers. Yu.Kh.Ayunts, M.I.Belovolov, V.I.Borodulin, E.M.Dianov, S.A.Pashko, V.P.Filimonov, A.B.Tsibulya, V.I.Shveikin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1428-32 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2197-203 (Nov. 1982). [received: May 1983]
Theoretical estimates are obtained and an experimental study is made of the coupling of radiation from stripe and channel semiconductor lasers into single-mode fiber waveguides of two-and three-layer (W) types. Investigations of several variants of the matching devices are reported. It is shown that sufficiently efficient matching of stripe light sources to single-mode waveguides is achieved by axisymmetric focusing components (focons) and a calculation is reported of the optimal parameters of focons. A method for the fabrication of focons is described. The power coupled into two- and three-layer (W-type) single-mode waveguides is in the range 0.5-1 mW. The coupling into W-type waveguides is more efficient than in the case of two-layer waveguides. (19 refs.)

On further development of the layer decomposition method applied to wave propagation in inhomogeneous media ....See Entry 66219

Chirp in picosecond film lasers and pulse compression by linear dispersion in optical fibers ....See Entry 66280

Theoretical fatigue life of helically stranded optical fibres ...... See Entry 68643

42.80Q Image detectors, convertors, and intensifiers

66407 Light-controlled transparencies for storing optical images. V.V.Belov, V.A.Elistratov, G.A.Lebedina, V.F.Nazvanov, E.P.Shebanin (Sci.-Res. Inst. of Mech. & Phys., N.G. Chernyshevskii State Univ., Saratov, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1359-61 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2210-14 (Nov. 1982). [received: May 1983]
Light-controlled storage transparencies (image converters) are studied systematically for the first time. The transparencies consist of stratified photoconductor-liquid crystal and photoconductor-electrochromic material structures. Photoconducting CdS:Na, Cu, and Cl films which exhibit photoelectric memory (residual conduction) at room temperature are used in the photoconducting layers. (15 refs.)

A compact synchroscan streak camera using a microchannel plate incorporated tube ....See Entry 66046

Background rejection in schlieren visualization ....See Entry 66374

42.80S Optical communications devices

66408 Information transmission equipment with light guides between stationary and mobile objects. H.Pohlers, R.Ide (Ingenieurhochschule Wismar, Wismar, Germany).
Fernmeldetechnik (Germany), vol.23, no.2, p.68-71 (1983). In German.
In communications, light pipes are arranged in a stationary manner mainly. However, for military purposes and certain public events temporary flexible

arrangements are advantageous, particularly in case simultaneous transmission of energy and signals is needed. Compared to wireless operation, transmission with a flexible light guide reduces the requirements for technical equipment. The principle of information transmission between stationary and mobile objects is explained. The mechanical and optical behaviour and properties of flexible light guides are analyzed. The main problem in the entire system is represented by the coupling of the two ends of light guides. All related aspects are discussed in detail. (6 refs.) *K.A.K.*

Demonstration of multilevel multichannel optical frequency shift keying (FSK) with cleaved-coupled-cavity (C^3) semiconductor lasers ....See Entry 66293

High-speed direct single-frequency modulation with large tuning rate and frequency excursion in cleaved-coupled-cavity semiconductor lasers ....See Entry 66302

Chromatic dispersion measurements in single-mode fibers using picosecond InGaAsP injection lasers in the 1.2- to 1.5-μm spectral region ....See Entry 66392

Single polarization optical fibers ....See Entry 66394

Matching of single-mode optical waveguides to semiconductor lasers ....See Entry 66406

Integrated optics: electrical fields control light ....See Entry 66410

42.82 INTEGRATED OPTICS

(for optical waveguides see also 42.80L)

66409 Integrated optics wave front measurement sensor. R.H.Rediker, T.A.Lind, F.J.Leonberger (Lincoln Lab., MIT, Lexington, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.647-9 (15 April 1983).
First results are presented demonstrating the feasibility of using an integrated optics array of Mach-Zehnder dielectric-waveguide interferometers to measure the phase and amplitude across an optical wave front. The interferometers are formed from single-mode waveguides produced by Ti diffusion into $LiNbO_3$. The spacings between the arms of the interferometer is 20 μm. The phase difference ϕ between the optical waves incident on the two interferometers arms is measured and compared with theory. The excellent and reproducible agreement between experiment and theory over a number of interferometers suggests that the accuracy of the wave front measurement sensor should be attractively high, limited only by signal statistics and noise considerations. As example, a sensor design is given for which the RMS deviation (1σ) in the value of ϕ is less than 4.5° (the RMS deviation in the optical path difference is less than $\lambda/80$). (6 refs.)

66410 Integrated optics: electrical fields control light. J.O.Akerlund.
Eltek. Aktuell Elektron. (Sweden), vol.26, no.6, p.20-1 (April 1983). In Swedish.
The author describes the function of integrated optical components for communication in the GHz region. The use of lithium niobate in such components is described, as well as the principles of the function of such devices. The range of possible operations such as modulation, time multiplexing and demultiplexing is also described. The author concludes by describing briefly the control of light by magnetic as well as acoustic devices. (no refs.) *H.J.P.*

66411 Geodesic lens of rotational symmetry with axis parallel to light propagation direction. M.Gaj, J.Osinski (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.189-94 (1982).
A new type of geodesic lens, of which the axis of rotational symmetry is parallel to the planar thin film waveguide has been proposed. In particular, the method of evaluation of a parallel beam of rays passing through this particular type of geodesic lens has been proposed and the results of numerical calculations have been presented. This lens is created by rotating the curve (generating curve) of the form $z=f(v)=a(1-v)^{1/2}$, where z—axis of symmetry (axis of revolution), v—normalized distance of surface point with the axis, a—constant factor. (6 refs.)

Analysis of factors influencing the threshold current of $Pb_{1-x}Sn_xSe$ injection heterolasers ....See Entry 66281

Modal analysis of separate-confinement heterojunction lasers with inhomogeneous cladding layers ....See Entry 66314

Nonlinear generation of the guided mode in an anisotropic thin-film optical waveguide ....See Entry 66339

Investigation of the photoelastic effect in titanium-diffused optical waveguides in lithium niobate ....See Entry 66384

Actively coupled index-guided lasers ....See Entry 66388

Single polarization optical fibers ....See Entry 66394

42.85 OPTICAL TESTING AND WORKSHOP TECHNIQUES

66412 Interferometric countercheck in precision cementing. G.K.Sharma, G.P.Dimri (Instruments Res. & Dev. Establ., Dehra Dun, India).
Appl. Opt. (USA), vol.22, no.8, p.1132-3 (15 April 1983).
It is possible by observing the number of Newton's rings in the air gap between the surfaces to be cemented to a doublet and comparing them with the ring pattern after cementing to deduce the nature of cementing and the uniformity or thickness of the cement layer. The authors discuss this feature and outline its applications. Considerable advantage is obtained if this procedure is followed to reduce subsequent failures due to improper cementing in the system as a whole. (1 ref.)

66413 Computer-controlled polishing of telescope mirror segments. R.A.Jones (Perkin-Elmer Corp., Norwalk, CT, USA).
Opt. Eng. (USA), vol.22, no.2, p.236-40 (March-April 1983).
A method of reducing the cost of large optical telescopes is the use of a segmented primary mirror. The computer-controlled polisher approach is ideally suited to the fabrication of telescope mirror segments. Since the process achieves controlled material removal by regulating the tool motion, there is no need for any surface symmetry. Recent experiments have demonstrated the ability of this process to figure mirror segments. (6 refs.)

66414 Self-calibrating surface measuring machine. A.H.Greenleaf (Itek Optical Systems, Lexington, MA, USA).
Opt. Eng. (USA), vol.22, no.2, p.276-80 (March-April 1983).
A new kind of surface-measuring machine has been developed under government contract at Itek Optical Systems, a Division of Itek Corporation, to assist in the fabrication of large, highly aspheric optical elements. The machine uses four steerable distance-measuring interferometers at the corners of a tetrahedron to measure the positions of a retroreflective target placed at various locations against the surface being measured. Using four interferometers gives redundant information so that, from a set of measurement data, the dimensions of the machine as well as the coordinates of the measurement points can be determined. The machine is, therefore, self-calibrating and does not require a structure made to high accuracy. A wood-structured prototype of this machine was made whose key components are a simple form of air bearing steering mirror, a wide-angle cat's eye retroreflector used as the movable target, and tracking sensors and servos to provide automatic tracking of the cat's eye by the four laser beams The data are taken and analyzed by computer. The output is given in terms of error relative to an equation of the desired surface. In tests of this machine, measurements of a 0.7 m diameter mirror blank have been made with an accuracy on the order of 0.2 μm rms. (no refs.)

Measurement of long radius of curvature ....See Entry 64882

Holographic interferometer for testing aspheric molds and molded parts ....See Entry 66234

Twin-channel substrate-mesa-guide injection lasers fabricated by organometallic vapor phase epitaxy ....See Entry 66272

Measurement of laser beam divergence ....See Entry 66291

Optimal regime for forming topological patterns when processing films with laser radiation ....See Entry 66319

Evaluation of wave aberrations of objectives. III. Analysis of lateral shearing interferograms. Experimental results ....See Entry 66363

Testing the quality of the operating surface of a parabolic devitrified glass astronomical mirror ....See Entry 66366

Universal measuring tube for testing telescope systems ....See Entry 66368

Specification and tolerancing of reflective test systems for IR and visible use ....See Entry 66370

Index instabilities in proton-exchanged $LiNbO_3$ waveguides ....See Entry 66381

Decreased losses in germanium-oxide glass optical fiber prepared by VAD method ....See Entry 66393

Determination of parameters of circular optical fibers with a step profile in refractive index ....See Entry 66396

Ion polishing with the aid of a planarizing film ....See Entry 68670

43.00 ACOUSTICS

(for audition, see 87.34; for speech, see 87.36; for sound effects on living matter, see 87.50C)

105th Meeting of the Acoustical Society of America (papers in summary form only received) ....See Entry 64577

43.20 GENERAL LINEAR ACOUSTICS

(see also 03.40K Mathematical problems in waves and wave propagation)

66415 On the Bragg-diffraction of surface acoustic waves by acoustic grating. Wang Zou-Qing, Zhou Su-Hua, Wang Cheng-Hao (Inst. of Acoustics, Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.156-67 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The surface acoustic wave diffraction phenomena on acoustic gratings in Bragg regime have been explored. The model approach has been used to treat this problem under strong Bragg condition. Some results, including the eigen-modes in the grating, the equation of the deflected angles, and the analytical expression of deflection efficiency which depends on the operation frequency and the grating parameters, have been obtained. Experimentally, the image of the diffraction acoustic fields on acoustic grating which was composed of some aluminium film stripes on y-cut $LiNbO_3$ crystals have been visualized by means of Schlieren method. Some excellent photographs of diffraction fields have been obtained, and the deflection angles and deflection efficiency at different frequency have been measured by using optical method. The comparison between the theoretical and the experimental results shows that the agreement is satisfactory. (13 refs.)

66416 On the scattering of sound by a vortex ring. M.S.Howe (Faculty of Math. Studies, Univ. of Southampton, Southampton, England).
J. Sound & Vib. (GB), vol.87, no.4, p.567-71 (22 April 1983).
An analytical treatment is given of the scattering of sound by a circular vortex ring translating at low Mach number in an unbounded stationary medium. The theoretical results complement the recent numerical investigation of this problem by Kambe and Myo Oo (1981). (6 refs.)

66417 Acoustics of an obstacle inside a reactive silencer. A.Bostrom (Inst. of Theoretical Phys., Goteborg, Sweden), B.Nilsson.
J. Sound & Vib. (GB), vol.87, no.4, p.603-19 (22 April 1983).
The transmission and reflection of sound in a cylindrical duct containing several discontinuities is investigated. A building-block method, which gives the transmission and reflection matrices for a complex system from those of the parts, is applied to bifurcations, sudden area changes with or without extended inlets, and spherical obstacles (which may be lossy). In some cases the solution can be interpreted in terms of multiple reflections. When the lengths between the discontinuities are small it is important to include also nonpropagating modes, and this is especially true when the sudden area change is obtained from the area change with extended inlet in the limit of vanishing inlet. For an expansion chamber (a portion of the duct with larger radius) with or without an obstacle and with or without inlets a number of numerical results with variation in frequency are presented. Numerical results for the various building-block elements of the expansion chamber are also considered. (15 refs.)

66418 Transmission of acoustical waves through a thin elastic plate in the cylindrical waveguide. D.P.Kouzov, G.L.Nikitin.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.24-30 (Feb. 1983). In Russian.
Sound transmission through a thin elastic plate in the cylindrical waveguide is investigated by analytical and numerical methods. Resonance classification for this system is given. (6 refs.)

66419 The edge field behaviour for the problem of the diffraction of a line source by a soft/hard half plane. A.D.Rawlins (Brunel Univ., Uxbridge, England).
Z. Angew. Math. & Mech. (Germany), vol.63, no.3, p.211-12 (1983).
The author discusses the diffraction of an acoustic wave by a half-plane. The edge field behaviour can be obtained from a result of Williams (1978). The

author also considers the more general problem of a line source, but this does not affect the edge field behaviour. (6 refs.)

66420 Difference equation technique for determining the evolution of radially symmetric ultrasonic fields. G.D.Dockery, R.O.Claus (Dept. of Electrical Engng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA). IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.511-15
A simplified difference equation technique has been developed to calculate the three-dimensional evolution of radially symmetric, complex ultrasonic fields. The parabolic approximation to the Helmholtz equation is obtained by assuming that localized changes in the magnitude of the field with respect to distance along the axis of propagation are small compared to those with respect to radial displacement. The Helmholtz equation in cylindrical coordinates may then be approximated, after separating variables, using truncated series expansions. The resulting difference equation determines complex field values at discrete locations in a plane using corresponding adjacent locations in the preceding plane. Stability criteria which determine acceptable values for various parameters are discussed. The technique has been applied to the propagation of ultrasonic fields generated by two-dimensional focusing and non-focusing, uniform and Gaussian profile, piezoelectric transducers in both profiled and non-profiled media. (7 refs.)

An iterative method for the Helmholtz equation ....See Entry 64695

43.25 NONLINEAR ACOUSTICS AND MACROSONICS

(see also 43.60 Acoustic signal processing; 43.88 Transduction; devices for generation and production of sound)

66421 Nonlinear quantum acoustics. V.A.Golenishchev-Kutuzov (Kazan Physicotech. Inst., Acad. of Sci., Kazan, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.574-8 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.145-8 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
This review gives a systematic presentation of nonlinear phenomena occurring during the propagation of acoustic pulses whose length is shorter than all the irreversible relaxation times in dielectric and magnetic materials under the conditions of resonance interaction with quantum ensembles in the medium. The particular feature of these phenomena is that relaxation processes cannot erase the phase memory of the excited system, so that its polarization is a nonlinear function of the amplitude and phase of the external field. Nonlinear phenomena such as induction, echo, and self-induced transparency were at first investigated only at radio frequencies under the conditions of NMR and ESR, but were subsequently detected in the optical range. Spin systems in solids have only recently begun to be investigated with the aid of acoustic pulses. (10 refs.)

66422 Measurements of harmonic profiles of a bounded ultrasonic beam in a liquid medium. D.D.McLennan, T.D.K.Ngoc, W.G.Mayer (Phys. Dept., Georgetown Univ., Washington, DC, USA).
Ultrasonics (GB), vol.21, no.3, p.103-6 (May 1983).
The acoustic field of a bounded finite-amplitude beam is governed by competing mechanisms such as medium non-linearity, interference, and attenuation. An analytic determination of the distribution of sonic energy in the individual harmonic components is often not reliable; consequently an experimental mapping of those harmonic components may be more appropriate. An experimental method is presented here which involves a miniature hydrophone probe which has been frequency calibrated for each harmonic component using a light diffraction technique. Measurements (made across the sound field) of the acoustic amplitude of the first three harmonic components are presented. (7 refs.)

66423 Non-linear behaviour and stability of trapped micron-sized cylindrical gas bubbles in an ultrasonic field. E.A.Neppiras, W.L.Nyborg, D.L.Miller.
Ultrasonics (GB), vol.21, no.3, p.109-15 (May 1983).
Stable arrays of cylindrical bubbles with diameters 3 and 4 μm were produced by trapping air in the pores of hydrophobic nuclepore filters. These bubble arrays were irradiated by beams of CW and pulsed ultrasound at carrier frequencies near the resonance frequencies of the trapped bubbles. By examining the frequency spectrum of the field scattered by the arrays it was found that the bubbles may oscillate as non-linear stable cavities of long duration. Using short pulses, the bubbles remain stable up to excitation pressure amplitudes of several bars. Mechanisms for the eventual growth and decay of the bubbles are discussed in light of the observations. (23 refs.)

Effect of a weak magnetic field on the acoustic properties of terbium near magnetic phase transitions ....See Entry 67987

43.30 UNDERWATER SOUND

(see also 92.10 Physics of the ocean)

Difference equation technique for determining the evolution of radially symmetric ultrasonic fields ....See Entry 66420

Measurements of harmonic profiles of a bounded ultrasonic beam in a liquid medium ....See Entry 66422

43.35 ULTRASONICS, QUANTUM ACOUSTICS, AND PHYSICAL EFFECTS OF SOUND

(for phonons in crystal lattices, see 63.; for plasma acoustics, see 52.35; for low-temperature acoustics and sound in liquid helium, see 67.; for acoustic properties of liquids, see 62.60; for acoustical properties of solids, see 62.65; for ultrasonic relaxation, see 62.80; for acoustic properties of thin films, see 68.60; for surface waves in solids, see 68.25; for acoustoelectric effects and acoustic wave amplification, see 72.50; for magnetoacoustic effects, oscillations and resonance, see 72.55; for acousto-optical effects and acoustic holography, see 78.20H and 43.63; for sound effects on living matter, see 87.50)

Periodic spatial coherence function resulting from acoustooptic interaction in the Bragg diffraction region ....See Entry 66207

Non-linear behaviour and stability of trapped micron-sized cylindrical gas bubbles in an ultrasonic field ....See Entry 66423

Ultrasonic wave propagation and its relation to molecular relaxation times in some organic liquids ....See Entry 67110

Ultrasonic switching of a bistable liquid crystal cell ....See Entry 68171

43.40 MECHANICAL VIBRATIONS AND SHOCK

(see also 46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves and shocks)

66424 Sound radiation from beams at low frequencies. S.A.L.Glegg (Inst. of Sound & Vibration Res., Univ. of Southampton, Southampton, England).
J. Sound & Vib. (GB), vol.87, no.4, p.637-42 (22 April 1983).
The radiation impedances of finite beams with different end conditions are discussed, and results are given for the lower order modes of clamped-clamped, free-free, cantilever and simply supported beams. (8 refs.)

43.50 NOISE, ITS EFFECTS AND CONTROL

(see also 86.70J Environmental science)

The sound of music [noise levels in concerts] ....See Entry 66430

The use of subminiature probe microphones to determine the attenuation of earmuff hearing protectors ....See Entry 66433

Characteristics of noise attenuators for use in acoustic emission studies ....See Entry 66435

43.55 ARCHITECTURAL ACOUSTICS

The sound of music [noise levels in concerts] ....See Entry 66430

43.60 ACOUSTIC SIGNAL PROCESSING

66425 A microcomputer based special analysis and multi channel monitoring system for dynamic signals. M.P.Sun.
Noise & Vib. Control Worldwide (GB), vol.14, no.2, p.45-7 (March 1983).
The technique of interfacing standard and well proved computer hardware to extend the capabilities of a basic spectrum analyser offers many advantages. The spectrum analyser retains the simplicity of a stand-alone instrument, uncluttered with built-in peripheral features which may or may not be required by the user. The reliability of such an instrument can be assumed to be better, since its only task is to rapidly Fourier transform the time signal. The microcomputer is a high-volume sales item resulting in cost advantages and good technical support. It is well suited to providing the post processing applications in terms of both speed and memory capability. Processing on both machines can take place in parallel and the spectrum analyser and computer can work independently of each other. Direct access to the software and a wide choice of optional hardware makes the system flexible and versatile, so that individual users' requirements may easily be implemented. (no refs.)

66426 Dispersive relay lines using 180° reflecting metal dot arrays. R.C.Woods (Plessey Res. (Caswell), Towcester.Ltd.,England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.4/1-4
The reflective array compressor (RAC) is a dispersive delay line designed for use in, for example, high performance pulse-compression systems. Recently, the 'in-line' RAC has been introduced using reflection by grooves once through 180°. Its advantages over conventional 90° reflective devices are that a single direction of propagation is used, there is only a single reflection so that the insertion loss can be low, and there is greater design flexibility since rapid changes in weighting can be accommodated. Both the 'in-line' and the conventional grooved RACs suffer from the disadvantage of requiring both photolithography and ion-beam milling for fabrication. Solie (1979) suggested the use of reflecting metal dot arrays to overcome this. The reflecting metal dots are produced simultaneously with the IDTs by photolithography; amplitude weighting of the passband response can be accomplished by varying the number density of dots on the surface. This paper reports the development of the in-line dot RAC in which the surface waves are reflected through 180° by arrays of thin aluminium dots. (5 refs.)

66427 Low loss SAW filter techniques. R.T.Biggs, F.S.McClemont (Hirst Res. Centre, GEC Res. Labs., Wembley, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.5/1-2
SAW filters employing two bidirectional interdigital transducers for input and output have typical insertion losses in excess of 20 dB. Electrical mismatch is necessary for the bidirectional transducer to reduce spurious signals within the filter which give rise to amplitude and group delay ripple within the passband. Various techniques for obtaining low loss together with low amplitude and group delay ripple have been reported. The implementation of any one of these methods depends upon the constraints of the problem, but in general it is the multiphase transducer which offers the most flexibility in bandpass shape, coupled with insertion losses dependent entirely on parasitics. (10 refs.)

66428 SAW convolver employing unidirectional transducers for improved efficiency and variable bandwidths. C.L.West (Ministry of Defence, Royal Signals & Radar Establ., Malvern, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.11/1-4
In the past few years the surface acoustic wave (SAW) convolver has become the subject of much investigation. The convolver operates through the non-linear interaction of two counterpropagating acoustic waves, usually SAW on a piezoelectric substrate such as $LiNbO_3$. In previously reported devices it has been usual to launch the SAW using conventional bidirectional interdigital transducers (IDT). These transducers have the inherent property that SAW are launched in both directions and therefore, as only one of these directions is useful, only half of the input power is employed in the device. A unidirectional transducer would eliminate this waste and, if properly matched to the source/load would also help to eliminate the acoustic reflections from the device thereby reducing self convolution levels. Unidirectional transducers can be realised using various schemes. Many of these produce unidirectional transducers which are narrow band (group type, meandering electrode) and are thereby not applicable to wideband convolvers. In this paper results are presented for convolvers with a centre frequency 300 MHz, bandwidths of 15-40% and high convolution efficiency -70 to -54 dBm. (12 refs.)

66429 Design, fabrication and application of acoustoelectric memory correlators. G.R.Adams (Standard Telecommunication Labs., Harlow, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.12/1-4
The combination of surface wave and semiconductor functions in a single monolithic structure represents a significant advance in the evolution of analogue signal processing devices. An important example of this class of processor is the SAW acoustoelectric memory correlator. In this device the r.f. electric field associated with a propagating surface wave is sampled and stored in a diode array where subsequently it can either be correlated with a copy of itself or recovered intact for retransmission. Memory correlators employing sputtered ZnO thin film overlays on a GaAs substrate, containing a matrix of Schottky diodes, are being researched at STL for applications as radar receiver matched filters and analogue r.f. memories. (no refs.)

Colloquium on 'Saw Devices' .... See Entry 64596

Overview of SAW devices .... See Entry 66441

43.75 MUSIC AND MUSICAL INSTRUMENTS

66430 The sound of music [noise levels in concerts]. K.Szymanski (State Inst. for Building, Warsaw, Poland).
Noise & Vib. Control Worldwide (GB), vol.14, no.2, p.54 (March 1983).
In order to discover whether participants at concerts of symphonic music are exposed to a dangerous level of noise, a series of measurements of equivalent continuous noise levels was made during symphonic concerts of the National Philharmonic Orchestra in Warsaw. The measurements covered 10 works composed by Mozart, Beethoven, Chopin, Debussy, Prokofiev and Panufnik. Amongst these works were symphonies, overtures, oratoria, violin and piano concertos. The measured levels start from 72.6 dB(A) for Mozart's violin concerto in A major (KV 201) and end at 85.3 dB(A) for Prokofiev's piano concerto No.3. The results obtained in this way show that symphonic music does not have any dangerous influence on the audience in concert halls. (2 refs.)

43.85 ACOUSTICAL MEASUREMENTS AND INSTRUMENTATION

(for acoustic noise measurement, see also 43.50; for photoacoustic spectroscopy, see 07.65)

66431 A new type of laser probe. R.G.Stearns, G.S.Kino, B.T.Khuri-Yakub (W.W. Hansen Labs. of Phys., Stanford Univ., Stanford, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.659-61 (15 April 1983).
A new technique to measure surface acoustic wave beam profiles is described. A measurement is made of the average phase change of the acoustic wave resulting from periodic heating of the sample surface by an incident modulated laser beam. Scanning of the laser beam across the acoustic wave results in a profile of the energy density in the acoustic beam. To measure the phase change, a surface acoustic wave oscillator configuration is used. Possible application of the technique to the measurement of applied and residual surface stress is discussed. (8 refs.)

66432 Precision methods for determining sound power levels. H.Schmidt.
Noise & Vib. Control Worldwide (GB), vol.14, no.2, p.38-42 (March 1983).
More and more frequently, the sound power level of machines is needed. For precision sound measurements, two dissimilar test methods are used; the reverberation room method and the free-field method in anechoic or semi-anechoic rooms. The author discusses the equipment and ventilation, the noise insulation, and the problem of access (entrance doors). Anechoic chambers are most frequently installed in mechanical and technical development centres. The chambers are also built for testing and calibrating electro-acoustic devices, as well as for audiological, auditory, psychological and physical tests. (4 refs.)

66433 The use of subminiature probe microphones to determine the attenuation of earmuff hearing protectors. J.L.Pehringer, D.A.Preves (Starkey Labs., Minneapolis, MN, USA).
Noise & Vib. Control Worldwide (GB), vol.14, no.2, p.49-53 (March 1983).
Determines the practicability and applicability of real ear probe microphone measurements in the determination of ear protector effectiveness. Employing the probe microphone technique is an innovative, reliable method for assessing the performance characteristics of a hearing protector device in situ. Based on experimental data, the feasibility and applicability of real ear probe microphone measurements of an earmuff's attenuation characteristics for a particular individual under actual conditions seems to be a viable alternative to the traditional method of obtaining attenuation data using theshold shift. (4 refs.)

66434 From laboratory to industry [ultrasonic materials testing]. V.Langone, R.Teti.
Tecnol. Elettr. (Italy), no.2, p.66-72 (Feb. 1983). In Italian.
Napoli University laboratory activity in materials testing by instrumentation using acoustic emissions is described. Instrumentation organisation is detailed showing testing range, basic requirements and instruments design. Acoustic emission detection techniques are highlighted quoting test results and elaborating test techniques. Usefulness in testing compound materials is underlined. (no refs.) *T.H.*

66435 Characteristics of noise attenuators for use in acoustic emission studies. G.G.Martin (Materials Engng. Dept., Monash Univ., Clayton, Victoria, Australia).
Ultrasonics (GB), vol.21, no.3, p.127-33 (May 1983).
The background noise generated by servo-hydraulic machines commonly used in laboratory tests of materials prevents the extraction of the maximum amount of acoustic emission data during fatigue experiments. Some of the solutions for removing background noise during monotonic tests are not applicable, and modern acoustic emission (AE) monitoring systems cannot detect all AE generated in the presence of continuous background noise. The best technique for reducing the background noise appears to be the insertion of a noise attenuating barrier between the noise source and the test specimen. Multilayer sound transmission theory is outlined to show that noise attenuators must be designed for the particular frequency at which the AE system is to operate. The theoretical basis for obtaining (for a given application) the optimum attenuation from attenuators constructed on an acoustic impedance mismatch basis is provided. Finally, physical properties of materials suitable for use in attenuator construction are tabulated. (17 refs.)

66436 SAW resonator performance. R.J.Smith (Central Materials Lab., Mullard Ltd., Mitcham, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.8/1-3
The aim of this work is to establish the technology for the manufacture of SAW resonators. A 404 MHz resonator on ST cut quartz has been used as the subject of the study. Whilst many areas of production technology have been investigated the achievement of target frequency and the subsequent frequency stability on storage have been major areas of investigation. (3 refs.)

Colloquium on 'Saw Devices' .... See Entry 64596

Ultrasonic-resonance method of determining transverse dimensions for fine fibers and wires .... See Entry 64886

Measuring procedure for transverse dimensions of fine rods and wires by the ultrasonic-resonance method .... See Entry 64887

Electret microphone for use in photoacoustic spectrometer and photoacoustic spectrum of some rare earth oxide powders .... See Entry 64963

Background rejection in schlieren visualization .... See Entry 66374

Measurements of harmonic profiles of a bounded ultrasonic beam in a liquid medium .... See Entry 66422

Dispersive relay lines using 180° reflecting metal dot arrays .... See Entry 66426

SAW convolver employing unidirectional transducers for improved efficiency and variable bandwidths .... See Entry 66428

Design, fabrication and application of acoustoelectric memory correlators .... See Entry 66429

Experimental technique for measurement of stress-acoustic coefficients of Rayleigh waves .... See Entry 66534

Use of domestic ultrasonic inspection equipment for thick-rolled sheet .... See Entry 68713

Automated inspection of corroded steel structures .... See Entry 68728

A proposed ultrasonic inspection technique for offshore structures .... See Entry 68729

Method for measuring transducer movement during underwater ultrasonic evaluation of weld flaws .... See Entry 68730

Enhancing the information yield of the ultrasonic inspection of welded joints with a permanent backing ring .... See Entry 68741

Quantitative determination of catalytic surface adsorption sites by Fourier transform infrared photoacoustic spectroscopy .... See Entry 68815

43.88 TRANSDUCTION; DEVICES FOR THE GENERATION AND REPRODUCTION OF SOUND

66437 Equivalent circuit and input impedance of a piezoelectric transducer with internal losses. V.I.Ivanov (Central Sci.-Res. Inst. of Technol. & Mech. Engng., Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.589-93 (Aug. 1982). Translation of: *Defektoskopiya (USSR),* vol.18, no.8, p.14-18 (Aug. 1982). [received: April 1983]
Expressions are derived for the electrical input impedance and equivalent circuit of a piezoelectric transducer with the rigorous inclusion of dielectric and mechanical losses. The results can be used to analyze the operation of piezoelectric transducers for ultrasonic flaw detection and acoustic emission. (6 refs.)

66438 Design of impedance-type ultrasonic lens system on basis of prescribed field distribution in focal plane. V.I.Korochentsev, A.V.Kuznetsov (V.V. Kuibyshev Far-Eastern Polytech. Inst., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.597-600 (Aug. 1982). Translation of: *Defektoskopiya (USSR),* vol.18, no.8, p.22-5 (Aug. 1982). [received: April 1983]
The law of impedance variation over the reference surface of an ultrasonic lens is determined which will yield a field of a given form in the focal plane. A sectorial field distribution in the focal plane is designed as an example. (6 refs.)

66439 Volumetric piezoelectric transducers with surface excitation. M.V.Korolev, A.E.Karpel'son, B.P.Starikov (Sci. Res. Inst. of Introscopy, Moscow, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.621-8 (Aug. 1982). Translation of: *Defektoskopiya (USSR),* vol.18, no.8, p.48-57 (Aug. 1982). [received: April 1983]
Surface-excited, resonant (volumetric) piezoelectric transducers having uniform and nonuniform polarizations are considered. Their amplitude-frequency responses in the transmitting and receiving modes are analyzed as well as the frequency dependence of the modulus of their electrical impedance. A study is made of the acoustic fields for various types of these piezoelectric transducers. (8 refs.)

66440 A calculation scheme for the optimum design of ultrasonic transducers. S.J.H.van Kervel (Electroson BV, Liempde, Netherlands), J.M.Thijssen.
Ultrasonics (GB), vol.21, no.3, p.134-40 (May 1983).
A calculation scheme that establishes the transfer function of a thickness-mode piezoelectric transducer is described. A computer program enables flexible manipulation of the design. Parameters that can be inserted are the properties of the piezo-material, the quarter-wavelength layer(s), the backing load and the electrical tuning and matching. Optimization criteria such as maximum bandwidth, optimum dynamic range, minimum pulse duration and minimum round-trip insertion loss (or maximum efficiency) are discussed. (8 refs.)

66441 Overview of SAW devices. C.W.Turner (King's College London, London, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.1/1
Almost 20 years have passed since the first SAW devices were demonstrated. The wide applicability of SAW devices in signal processing was not immediately recognised at first, but major improvements in interdigital electrode transducers stimulated a rapid growth of R and D effort in SAW technology. Nowadays system designers can call upon a variety of mature SAW devices able to meet demanding specifications in the frequency range from about 10 MHz to over 1 GHz. (no refs.)

66442 Reflection of surface acoustic waves by thin metal dots. F.Huang, E.G.S.Paige (Dept. of Engng. Sci., Univ. of Oxford, Oxford, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.2/1-3
In a common configuration for SAW devices, frequency-selective transducers convert an electrical signal into an acoustic wave and back to an electrical

signal. Both transduction and the response of the device are determined by the transducer. An alternative arrangement is to have frequency-selective reflecting arrays in the acoustic beam; the transducers can then be designed with fewer constraints and be made as efficient as possible. One source of reflection is the metal partly shorting out the potential that accompanies the surface wave on a piezoelectric material. With strips on a strongly piezoelectric material, this can give an inconveniently large reflection. The replacement of the strip with a row of dots gets over this problem. This paper describes a theory to determine reflectivity and change of velocity due to thin metal dots. Experimental results are also given. Thick dots, whose reflection mechanism is primarily mechanical rather than piezoelectric, are not described here. (2 refs.)

66443 Wave analysis of IC-compatible UHF BWCR (bulk wave composite resonator). R.F.Milsom, W.Pollock (Philips Res. Labs., Redhill, England).
Colloquium on 'Saw Devices', London, England, 23 Feb. 1983 (London, England: IEE 1983), p.14/1-6
Fundamental mode UHF bulk acoustic wave (BAW) resonators have received considerable attention in recent years. One configuration of special interest is the thickness extensional mode resonator employing zinc oxide thin films on silicon. The attraction of these devices is that they offer integration of high Q-factor BAW resonators and filters with other IC components. Theoretical analysis of these devices has been limited to a comparatively simple one-dimensional model. Here details of a two-dimensional analysis are presented. It is shown that there is strong coupling between the fundamental extension motion and the second harmonic shear motion, giving rise to a family of inharmonic modes closely spaced in frequency. This type of resonator response has been observed and described in earlier work. The equivalent electrical parameters of these resonances are computed as functions of the resonator geometry. (10 refs.)

Colloquium on 'Saw Devices' .... See Entry 64596

44.00 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

44.10 HEAT CONDUCTION (MODELS, PHENOMENOLOGICAL DESCRIPTION)

66444 The heat equation with singular coefficients. I. Operators of the form $-d^2/dx^2+\kappa/x^2$ in dimension 1. C.J.Callias (Dept. of Math, Columbia Univ., New York, NY, USA).
Commun. Math. Phys. (Germany), vol.88, no.3, p.357-85 (March 1983).
The small time asymptotics of the kernel of e^{-tH} is defined and derived for $H=d^2/dx^2+\kappa/x^2$ on $\mathbf{R}^1$. Lemmas on singular asymptotics in the sense of distributions are formulated and used. The results are applied to derive an index formula on $\mathbf{R}^1$. (9 refs.)

66445 A new proof and generalization of the maximum principle of heat conduction. H.Farkas (Inst. of Phys., Tech. Univ. Budapest, Budapest, Hungary).
J. Non-Equilibrium Thermodyn. (Germany), vol.7, no.6, p.355-62 (1982).
The physical content of the maximum principle of heat conduction is discussed. It is shown that the maximum principle is closely related with the second law of thermodynamics. A generalization of the maximum principle valid for a wide class of heat conduction problems is proved on the basis of the Governing Principle of Dissipative Processes. (17 refs.)

66446 Heat conduction through a thin, poorly conductive layer. L.E.Bobisud (Univ. of Idaho, Moscow, ID, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.85-97 (April 1983).
The author considers a model in which a thin sheet of poor conductivity occurs between two conducting materials and seeks an asymptotic representation as the thickness and conductivity of this sheet go to zero. A change in the form of the connection condition is anticipated as a reflection of the singularity of the perturbation. (3 refs.)

A boundary integral equation for the solution of a class of problems in anisotropic inhomogeneous thermostatics and elastostatics .... See Entry 64687

44.25 CONVECTIVE AND CONSTRAINED HEAT TRANSFER

(see also 47.25Q Convection and heat transfer)

An analysis of thermal instabilities in obliquely aligned layers of a nematic liquid crystal .... See Entry 66824

44.30 HEAT TRANSFER IN INHOMOGENEOUS MEDIA AND THROUGH INTERFACES

66447 The unsteady heat transfer from an oscillating sphere in a viscous fluid. N.Dohara (Dept. of Mech. Engng., Iron & Steel Tech. Coll., Hyogo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1178-85 (April 1983).
The problem of unsteady heat transfer from a solid sphere, performing harmonic oscillations in an unbounded viscous fluid otherwise at rest, is investigated for small values of the Reynolds number. The analysis on the temperature field is carried out up to the third order of the Reynolds number. The time-averaged Nusselt number is obtained. The mechanisms of the oscillatory heat transfer are clarified theoretically. (8 refs.)

66448 Phonon transmission theory of heat transfer through solid-gas interfaces. G.Dharmadurai (Reactor Res. Centre Kalpakkam, Tamil Nadu, India).
Phys. Status Solidi b (Germany), vol.116, no.1, p.307-11 (1 March 1983).
The heat flow is investigated from a hot solid into a gaseous medium using the phonon transmission theory. This basic approach correctly predicts the essential features of the temperature jump occurring at solid-gas interfaces during heat flow across the boundary and the predictions agree well with recent measurements of heat transfer between microspheres of UO_2 in helium and nitrogen atmospheres. The results suggest that the medium-medium acoustic mismatch dominates the heat transfer through these interfaces. (10 refs.)

Characterization of multilayer insulation at cryogenic temperature .... See Entry 64912

44.50 THERMAL PROPERTIES OF MATTER (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 07.20 Thermal instruments and techniques)

Latent heat and low-temperature heat capacity experiment for the general physics laboratory .... See Entry 64621

A new high-precision continuous-heating differential calorimeter for the temperature range 1.5K to 300K .... See Entry 64906

One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. I. The analytical solutions .... See Entry 65339

One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. II. Numerical analysis .... See Entry 65340

On the use of penetration depth in thermal transient finite element analysis .... See Entry 67297

44.60 THERMODYNAMIC PROCESSES (PHENOMENOLOGY, EXPERIMENTAL TECHNIQUES)

(see also 05.70 Thermodynamics, 07.20 Thermal instruments and techniques)

66449 An apparatus for the investigation of low-temperature, high-pressure, vapor-liquid and vapor-liquid-liquid equilibria. W.Dorau, H.W.Kremer, H.Knapp (Inst. of Thermodynamics & Plant Design, Tech. Univ., Berlin, Germany).
Fluid Phase Equilibria (Netherlands), vol.11, no.1, p.83-9 (April 1983).
A fluid phase equilibrium apparatus has been designed, built and tested for an operating range of $70<T<300K$ and $1<p<200$ bar. It consists of a high-pressure cell with an optical inspection device, a gas circulation system, a cryostat, and instrumentation for the measurement or control of temperature, pressure and composition. Accurate experimental VLE and VLLE data are useful as a basis for process design or for testing and improvement of correlations. (3 refs.)

44.90 OTHER TOPICS IN HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES

66450 Effective monochromatic emissivity of cavity with arbitrary anisothermality. S.P.Rusin, K.S.Mukhamed'yarov (Inst. for High Temperatures, Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.545-51 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.658-64 (July-Aug. 1982). [received: April 1983]
Data are presented for a computer experiment for several temperature distributions typical in the measurement of the temperature from cavity radiation. It is found that, if the temperature at a given point is less than that of the other points on the surface of the cavity, there will be in general a wavelength for which the measured brightness temperature will be equal to the true temperature. In the measurement of brightness temperature a crucial role is played by a temperature function which depends strongly on the temperature level and on the wavelength of the radiation being recorded. A simple method for estimating the effective emissivity of an anisothermal cavity is introduced. (6 refs.)

Heat load limits in laser mirrors with a cooled porous backing .... See Entry 66292

Investigation of flow distribution in cells with triangular tubular bundles .... See Entry 66568

46.00 MECHANICS, ELASTICITY, RHEOLOGY

46.10 MECHANICS OF DISCRETE SYSTEMS

(see also 03.20 General mathematical aspects)

66451 On static and dynamic finite element analysis of helical springs and experimental verifications. Wen-Hwa Chen, Pwu Tsai (Dept. of Power Mech. Engng., Nat. Tsing Hua Univ., Hsinchu, Taiwan).
J. Chin. Inst. Eng. (Taiwan), vol.6, no.1, p.9-20 (Jan. 1983).
Based on the variational principles, the authors present a rigorous finite element procedure to study the static and dynamic characteristics of helical springs. To characterize the effects of curvature, torsion (or pitch angle), shear force and rotary inertia, the so-called 'space-curved' beam element is devised. Results show that the 'space-curved' beam finite element model accurately reveals the significant influence of curvature, torsion (or pitch angle) and shear force effects on the computation of tension and torsion constants. Furthermore, the present model can be used to predict tension, torsion and mixed-mode natural vibrations can compensate for the lack of experimental and classical approaches. Good correlation between the directly computed 'space-curved' beam finite element solutions and experimental results has also been established for the spring subjected to impact loadings. Lastly, a large-deflection dynamic analysis is employed to study the effect of geometric nonlinearity. (19 refs.)

66452 Attitude stability of torque-free axisymmetric dual spinners with energy sinks, considering spin change allotment between rotor and platform. F.Rimrott, You-Sin-Li (Dept. of Mech. Engng., Univ. of Toronto, Toronto, Ontario, Canada).
Mech. Res. Commun. (GB), vol.9, no.6, p.403-10 (Nov.-Dec. 1982). [received: March 1983]
The authors introduce a spin change allotment factor η, by means of which the energy flow between rotor and platform can be clearly quantified. This makes it possible to differentiate between the kinetic energy change dT^R of the rotor and the energy dD^R absorbed by the rotor, and between the kinetic energy change dT^P of the platform and the energy dD^P absorbed by the platform. An exact value of η cannot be quoted a priori for a given dual spinner. It is, however, possible in principle to measure it in an experiment. The spin change allotment factor η includes all effects that contribute to damping, with the exception of frequency. (3 refs.)

66453 Optimal displacement of a pendulum with a phase constraint on the velocity of the suspension point. A.T.Zaremba.
Mech. Solids (USA), vol.17, no.3, p.22-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.28-34 (1982).
Considers the problem of time-optimal displacement of a pendulum from a rest state over a specified distance with suppression of oscillation at the end of the process. It is assumed that the acceleration of the suspension point of the pendulum does not exceed some maximum permissible absolute value, and also that the velocity of the suspension point is bounded, and this leads to a control problem with a phase constraint. The constraints considered reflect the basic operating properties of electric drives for hoisting machines, which provide smooth (i.e. roughly constant) acceleration or deceleration of the system with a limited maximum displacement velocity. (7 refs.)

66454 Vibration damping by controlling the stiffness. H.Loose, B.Heimann.
Mech. Solids (USA), vol.17, no.3, p.28-36 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.35-44 (1982).
Investigates a mechanical system consisting of a vibrating mass and linear-elastic element with controlled stiffness (damper), which connects the mass to a fixed foundation. The problem of optimal suppression of vibrations which arise after impulsive impacts is solved by controlling the stiffness of the damper, when the system is acted upon by a constant force. Free vibration of the resultant system (exact and approximate solution) is considered. An asymptotic approximation to periodic steady forced vibration of the system under a harmonic load with constant and frequency-dependent amplitude is constructed. (8 refs.)

66455 Problem of impact of a two-element mechanism. E.M.Rubanovich, A.M.Formal'skii.
Mech. Solids (USA), vol.17, no.3, p.37-43 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.45-51 (1982).
Considers a plane mechanism consisting of two hinged elements. The end of one of the elements is located on an impenetrable surface, i.e. a nonconfining constraint is imposed on the system. At some point in time the end of the other element touches the surface with an absolutely inelastic impact. The motion of the system after impact is investigated. The authors consider the case of arbitrary direction (prior to impact) of the velocity vector of the end of the impacting element, when new effects arise. The results are of interest for problems involving the dynamics of bipedal locomotion. (8 refs.)

On the amplitude decay of strongly non-linear damped oscillators .... See Entry 64664

Analysis of non-linear autonomous conservative oscillators by a time transformation method .... See Entry 64665

The determination of dynamic factors in a system with two degrees of freedom and Duffing-Hertz nonlinearity .... See Entry 64667

Discrete and non-discrete mixed methods applied to eigenvalue problems of plates .... See Entry 66457

Transverse vibrations of a beam forced by discrete material system .... See Entry 66503

Mathematical models of the methods for calculations of shape and tensile forces in moving thread systems .... See Entry 66545

46.20 CONTINUUM MECHANICS

(see also 03.40 General mathematical aspects)

66456 Methods for computing optimal bounds on deformation in the theory of workhardening adaptation. I.Kaneko (Univ. of Wisconsin, Madison, WI, USA), C.Mazzarella, C.Polizzotto.
Comput. Methods Appl. Mech. & Eng. (Netherlands), vol.37, no.2, p.185-204 (April 1983).
Deals with rigid-workhardening structures subjected to dynamic loadings. Within the theory of workhardening adaptation, a bounding technique is studied. Numerical methods for computing optimal bounds on deformation are given and illustrated by means of a simple frame structure. It is demonstrated that the computed optimal bounds are fairly accurate. (16 refs.)

66457 Discrete and non-discrete mixed methods applied to eigenvalue problems of plates. F.Fujii, T.Hoshino (Dept. of Civil Engng., Gifu Univ., Gifu, Japan).
J. Sound & Vib. (GB), vol.87, no.4, p.525-34 (22 April 1983).
A mixed variational formulation for eigenvalue problems of plates is presented. Spline functions with multiple nodes are used to interpolate the displacement and moment fields. The solution procedure can be applied in either discrete or non-discrete forms. In contrast with displacement methods, the specified boundary conditions can be considered very easily by introducing multiplicity in the boundary nodes. Numerical examples include buckling and free vibration, of rectangular plates, with in-phase loading and or elastic foundations. The accuracy of the results obtained and the superiority of the mixed methods presented to conventional displacement approaches are discussed. (15 refs.)

66458 Toward an extremum characterization of kinetic stability. J.G.Papastavridis (School of Engng. Sci. & Mech., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Sound & Vib. (GB), vol.87, no.4, p.573-87 (22 April 1983).
The Hamiltonian action-based stability ideas of Routh (1905) are combined with Trefftz's (1933) variational formulation of the adjacent configuration method of static buckling into a comprehensive time-integral-of-energy-based extremum criterion of kinetic stability. Specifically, if the action functional along a fundamental path is a minimum for an arbitrarily long time interval of integration then the path is unstable, whereas if it ceases to do so at some point, then the path is stable up to that point; this latter leads to a direct method for approximate stability limit calculations. Some relevant analytical tools are also discussed, and finally applications of the criteria to the stability of equilibrium, and that of the steady state of Duffing's (cubic and harmonically-forced) oscillator are presented. (29 refs.)

66459 On the solar coefficient in Timoshenko's beam theory. J.J.Jensen (Dept. of Ocean Engng., Tech. Univ. of Denmark, Lyngby, Denmark).
J. Sound & Vib. (GB), vol.87, no.4, p.621-35 (22 April 1983).
Some existing formulations for the shear coefficient in Timoshenko's beam theory are discussed, especially through evaluation of the accuracy to which natural frequencies of simply supported, prismatic, thin walled beams can be obtained. The main conclusion drawn is that if a consistent expression for the shear coefficient, such as those given by Cowper [1966] or Stephen [1980], is used in Timoshenko's beam theory, then very high accuracies can be expected for the natural frequencies, even for wavelengths of the same magnitude as the transverse dimension of the beam. It is noted that no reduction of the moment of inertia due to shear lag effects should be made as these effects are included in the consistent formulas for the shear coefficient. Finally, some apparently paradoxical results indicating that a reduction in shear stiffness occurs in rare cases if more material is added to a section are discussed and explained as resulting from the use of integrated rather than pointwise deflection measures in the derivation of consistent shear coefficient expressions. The results are discussed in the light of the importance of the shear stiffness of the hull girder in ship hull vibration analysis. (15 refs.)

66460 Equations of the linear theory of shells with slowly varying curvatures. S.Lukasiewicz (Politech. Warszawska, Warsaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.167-79 (1981). In Polish.
The fundamental equations are presented of the theory of shells with slowly varying curvatures. In comparison with the author's previous work, a consistent and complete derivation of the fundamental equations is given. The system of differential equations of the theory of shells has been reduced to the system of two differential equations for the normal deflection and the stress function. Two variants of the differential equations have been analysed and it has been proved that in the case of shells of slowly varying curvature they lead to identical fundamental equations. (7 refs.)

66461 An analysis of rod-shield constructions by the finite element method. E.Rusinski (Polytech. Wroclawska, Wroclaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.253-60 (1981). In Polish.
The method of calculating any rod-shield construction by the finite element method is shown. The rigidity matrix of the rod-shield construction for elements of rectangular and triangular shape with three degrees of freedom is given. In a rod-shield element any shape of the rod cross-section may be applied. The rigidity matrix of a rectangular shield and of a four bars frame is also given. The PRTA program was written in FORTRAN 1900 language and was tested on an ODRA 1300 computer. (12 refs.)

66462 The variational principles of mechanics for variable domains and their utilization for structural optimization. K.Dems (Politech. Lodzka, Lodz, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.269-83 (1981). In Polish.
Provides the virtual displacement and stress principles in the case when simultaneous variation of external or internal boundaries bounding an elastic body is considered. Both the conservative and nonconservative, dependent on boundary configuration, load systems are considered. The problem of mean compliance design of a structure with unspecified in advance shape is considered. The optimality conditions are generated for the case of optimal shape design of loaded and free external boundaries as well as for design of interfaces separating materials of different stiffness. (11 refs.)

Damage tensors in continuum mechanics .... See Entry 64679

An alternative proof of the representation theorem for isotropic, linear asymmetric stress-strain relations .... See Entry 64680

Minimum-weight thin-walled cylinders of given torsional and flexural rigidity .... See Entry 66474

Finite plastic deformation of a circular membrane under hydrostatic pressure. I. Rate-independent behaviour .... See Entry 66480

Finite plastic deformation of a circular membrane under hydrostatic pressure. II. Strain-rate effects .... See Entry 66481

46.30 MECHANICS OF SOLIDS AND RHEOLOGY

(see also 62.20 Mechanical properties of solids, as related to microscopic structure)

An alternative proof of the representation theorem for isotropic, linear asymmetric stress-strain relations .... See Entry 64680

46.30C Static elasticity

66463 Boundary element method in elastostatics: theory and applications. G.Kuhn (Lehrstuhl Tech. Mech., Univ. Erlangen-Nurnberg, Erlangen, Germany), W.Mohrmann.
Appl. Math. Modelling (GB), vol.7, no.2, p.97-105 (April 1983).
Presents the theoretical foundations of the boundary element method as they are applied in the numerical code BETSY (for: boundary element code for thermoelastic systems). The code is applicable to linear elastostatic problems including thermoelasticity allowing stationary temperature fields and nonvanishing volume forces. When the theoretical fundamentals of the method are presented, a unified approach to the transformations of domain integrals into boundary integrals is formulated, encompassing both plane and spatial problems. The application range of the method is increased by introducing an unbounded solution and by eliminating the domain integral expression due to volume forces. Two illustrative examples show the code in action, pointing out the fundamental usefulness for practical applications. (14 refs.)

66464 Stresses in an internally pressurized thin rectangular prismatic duct. M.Holland (Dept. of Mech. Engng., Liverpool Polytech., Liverpool, England).
Proc. Inst. Mech. Eng. Part C (GB), vol.197, p.71-3 (March 1983).
An elastic analysis is developed which results in equations for the prediction of stresses at principal positions in the duct. These equations express the stress as a function of the aspect ratio and the ratio of the thickness of adjacent sides (opposite sides are taken to be of the same thickness). It is shown that for a fixed 'longest side' length, an optimum stress condition is achieved when the aspect ratio is two-to-one and the four sides have the same wall thickness. (no refs.)

66465 A rational theory of oblique incidence and its extension to stress-separation in birefringent composites. S.K.Chaturvedi (Dept. of Engng. Sci., Univ. of Florida, Gainesville, FL, USA).
Exp. Mech. (USA), vol.23, no.1, p.36-41 (March 1983).
A rational theory of oblique incidence for a birefringent medium is developed. The theory rules out the concept of secondary principal stresses as an arbitrary one and provides more adequate interpretation of isochromatics and isoclinics in oblique incidence. The method is shown to be applicable for stress-separation in an anisotropic-birefringent composite, and the stress-optical equations deduced require an additional stress-fringe constant to those involved in normal incidence. The stress-birefringence relations for isotropic photoelasticity are obtained as a particular case of the general theory. (14 refs.)

66466 An approximate method of orthotropic photoelastic analysis. B.D.Agarwal (Dept. of Mech. Engng., Indian Inst. of Technol., Kanpur, India).
Exp. Mech. (USA), vol.23, no.1, p.55-8 (March 1983).
An approximate strain-optic law has been derived for photoelastic analysis of orthotropic model materials. Principal-strain difference and the direction of major principal strain can be obtained from only two photoelastic measurements (isochromatic-fringe order and isoclinic angle) by means of this

strain-optic law. Limited experiments on models subjected to uniaxial and biaxial stresses indicate good agreement between the experimental results and predictions of the strain-optic law. A parametric study demonstrates that the difference can be predicted within ± 20 percent for most practical values of degree of orthotropy and ratio of principal strains. The error levels are quite acceptable considering the significant ease in analysis provided by the new law and the fact that such error levels are not uncommon in experimental investigations. (8 refs.)

66467 Further considerations on the problem of torsion and flexure of prismatical beams. E.Reissner (Dept. of Appl. Mech. & Engng. Sci., Univ. of California, La Jolla, CA, USA).
Int. J. Solids & Struct. (GB), vol.19, no.5, p.385-92 (1983).
A linear system of one dimensional beam equations is established through use of the principle of minimum potential energy in conjunction with suitable displacement approximations, which takes account of warping stiffness in addition to stretching, transverse shearing, bending and twisting stiffness. This system of equations is used for the asymptotic analysis of a warping boundary layer, including the concept of contracted and reduced boundary conditions for the determination of the state of the beam outside the layer, as well as for the derivation of expressions for cross sectional shear centre coordinates which are more general than previous expressions for these quantities. (4 refs.)

66468 Thermal stress of square region with an elliptical hole. E.Matsumoto, T.Sekiya (Dept. of Aeronaut. Engng., Univ. of Osaka Prefecture, Sakai, Osaka, Japan).
Mech. Res. Commun. (GB), vol.9, no.6, p.397-402 (Nov.-Dec. 1982). [received: March 1983]
The problem of thermal stress with internal heat generation in the square region with an elliptical hole at the center is described. A point-matching method is utilized selecting the appropriate points on the boundaries for numerical calculation. It is shown that the plane thermoelastic problems can easily be formulated by a mechanical analogy, and this method is applied to solve the problem. (4 refs.)

66469 Averaged equations of the theory of elasticity of matrix composites. M.I.Gandel'sman.
Mech. Solids (USA), vol.17, no.3, p.54-61 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.63-70 (1982).
Within the framework of the self-consistent field method, a systematic derivation of the averaged equations is offered for bounded regions of matrix composite. It is shown that description of the elastic properties of the composite by means of effective moduli corresponds to allowance for interaction of inclusions in the dipole approximation. In this approximation, the theory in question is analogous, from the mathematical standpoint, to the traditional electrostatics of dielectrics. Allowance for high-order multipole terms leads to the appearance in the averaged elastic-equilibrium equations of additional terms with high-order derivatives of the averaged tensor $\epsilon(x)$. Additional terms also appear in the equations that specify the boundary conditions. Thus, allowance for interaction of inclusions in high-order multipole approximations leads to averaged elastic-equilibrium equations, which can be regarded as a variant of multipolar elasticity theory. In this case the description of the elastic properties of the composite is not exhausted by introducing the tensor of the effective moduli. (12 refs.)

66470 Prefailure scheme for composites near holes. A.N.Polilov.
Mech. Solids (USA), vol.17, no.3, p.97-103 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.110-17 (1982).
A scheme is proposed for describing prefailure of composites that leads to 'blunting' of a hole or notch and to a decrease in the effective stress concentration coefficient. The hypothesis of constant size of the prefailure zone, characteristic of the given material, enables one to describe the strength as a function of the dimensions of the stress concentrators by using one experimental parameter, for an extensive class of holes and notches. (12 refs.)

66471 Deformation of an elastic plane reinforced by a periodic system of nonperiodically loaded oblique semi-infinite stringers. G.A.Kamysheva, B.M.Nuller, M.B.Ryvkin.
Mech. Solids (USA), vol.17, no.3, p.104-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.118-23 (1982).
Cyclical symmetry can be used to solve the problem of deformation of a plane weakened by a system of radial cracks. The procedure is applied to the contact problem of deformation of an infinite elastic plate reinforced by a periodic system of semi-infinite rectilinear stringers whose ends lie on the same straight line, are in complete adhesion with the plate, offer no bending resistance, are parallel to one another, and make an arbitrary angle with the straight line in question. A cyclical or arbitrary system of longitudinal tensile forces is applied to the ends of the stringers. The solution is obtained in quadratures. A formula is given for the stress intensity coefficients in the neighborhood of the ends of the stringers. As a result of numerical analysis, it is shown that it is possible to use a simple approximate formula for the intensity coefficient. (10 refs.)

66472 Bending of elastic plates with a regular structure. E.I.Grigolyuk, M.G.Gringauz, V.N.Dolgikh, L.A.Fil'shtinskii.
Mech. Solids (USA), vol.17, no.3, p.110-15 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.124-30 (1982).
Doubly periodic problems of bending of plates with curvilinear holes or elastic inclusions are reduced to systems of Fredholm integral equations of the second kind. An algorithm for determining the stresses and the effective stiffness parameters is given; results of calculations are presented. (11 refs.)

66473 A second order theory for large deflections of slender beams. P.Pleus, M.Sayir (Inst. fur Mech., Swiss Federal Inst. of Technol., Zurich, Switzerland).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.192-217 (March 1983).
The classical theory of finite deformations for slender beams was mainly developed by Euler and Kirchhoff and assumes linear-elastic constitutive behaviour. But finite deformations lead a priori to a problem of nonlinear elasticity. Introducing dimensionless quantities, one realizes the importance of two small parameters which characterize the slenderness of the beam and the relation between the loading and the stiffness of the material. The asymptotic approximation of first order with respect to these two parameters confirm in the case of the 'elastica' the Kirchhoff equations. For the second order approximation the authors restrict the discussion to the case, where the centerline of the beam bends as a plane curve in first order. Under this assumption, they derive general equations of second order and discuss some special cases. They show that local stress and strain fields of second order are always influenced by physical nonlinearities. The importance of the nonlinear effects is illustrated in some numerical examples. (9 refs.)

66474 Minimum-weight thin-walled cylinders of given torsional and flexural rigidity. B.L.Karihaloo, W.S.Hemp.
Report OUEL-1438/82, Univ. Oxford, England (Nov. 1982), 11 pp.
Obtains, in an analytical form, the shape of a doubly symmetrical thin-walled cylinder of constant wall thickness and given contour length that uses the least amount of material in providing prescribed minimum stiffness in torsion and in bending in a principal plane. The shape optimization problem is defined parametrically, and the resulting necessary optimality condition is solved in a closed form.

Progress in boundary element methods. Vol.2 .... See Entry 64606

On the Saint-Venant principle in elasticity .... See Entry 64682

Exact solutions for a certain hyperbolic 2-conservation law .... See Entry 64684

Stress-concentrations in a thin insulated metallic disc in the form of an inverse of an ellipse lying horizontally in a uniform electric field .... See Entry 64686

A boundary integral equation for the solution of a class of problems in anisotropic inhomogeneous thermostatics and elastostatics .... See Entry 64687

One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. I. The analytical solutions .... See Entry 65339

One-dimensional problems of temperature and heat flux determination at the surfaces of a thermoelastic slab. II. Numerical analysis .... See Entry 65340

Nonlinear statics and dynamics of thin axisymmetric shells by high precision finite elements .... See Entry 66475

An experimental determination of the fields of strains and stresses in the elastoplastic range .... See Entry 66478

Stress state for off-axis tension of perforated materials .... See Entry 66487

Stressed state of a half-plane reinforced by a beam and stringer, with allowance for the development of plastic deformation .... See Entry 66488

Elastic-plastic bending of beams in the process of motion .... See Entry 66489

Coupled *P* and *SV* waves propagating in spherical elastic layers. Exact solution and interpretation .... See Entry 66497

Waves in weakly anisotropic media .... See Entry 66505

Three-dimensional curved crack in an elastic body .... See Entry 66515

Contact between an elastically supported circular plate and a rigid indenter .... See Entry 66525

Experimental study of inelastic strain patterns in a model of a tube-plate ligament using an interferometric moire technique .... See Entry 66529

Epon 828 epoxy: a new photoelastic-model material .... See Entry 66530

An introduction to dynamic photoelasticity. Discussion .... See Entry 66531

Identification of isochromatic fringes .... See Entry 66537

Nondestructive residual-stress measurement in a wide-flanged rolled beam by acoustoelasticity .... See Entry 66538

Modelling intrinsic stresses by setting up Somigliana dislocations .... See Entry 67005

Properties of stresses in composites with ribbon-like inclusions .... See Entry 68581

46.30J Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation

(inc. rheology of solids)

66475 Nonlinear statics and dynamics of thin axisymmetric shells by high precision finite elements. W.Borkowski, M.Kleiber (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.1, p.15-37 (1982).
Fundamental equations of the finite element model for an arbitrary axisymmetric thin shell subjected to axisymmetric loadings are studied in the paper. Both different constitutive models (elasticity, elasto-plasticity, creep, elasto-viscoplasticity) and large deformation effects are taken into account. A number of examples illustrate the application of the approach to the numerical nonlinear static and dynamic analysis of shells. (17 refs.)

66476 Interference effect of notches. I. An evaluation of interference effect of notches on yield point load of notched bar with double U-notches by upper and lower bound theorems. T.Majima (Chiba Univ., Chiba, Japan).
Bull. JSME (Japan), vol.26, no.212, p.179-85 (Feb. 1983).
The interference effect of notches on yield point load is analysed by the upper and lower bound theorems for a specimen with double U-notches which is subjected to tensile load under the plane strain and axisymmetrical deformation. The notch pitch range influencing the interference effect on yield point load obtained by theory is in good agreement with that on general yielding load obtained by experiment. The kinematically admissible velocity field with velocity discontinuity and the statically admissible stress field with stress discontinuity employed are proved to be available in predicting the interference effect of notches. These methods of calculating the upper and lower bounds can be applied to the problems of the interference effect of V-notches or cracks. (5 refs.)

66477 Yield design: Norton-Hoff regularization and augmented Lagrangian. T.Guennouni, P.Le Tallec (Lab. Central des Ponts et Chaussees, Paris, France).
J. Mec. Theor. & Appl. (France), vol.2, no.1, p.75-99 (1983). In French.
Describes a kinematical method for yield design which leads to a convenient numerical treatment of three-dimensional bodies and nondifferentiable yielding criterion. The kinematical problem is first regularized through the introduction of the Norton-Hoff viscoplastic fluid associated with yielding criterion, then numerically solved by augmented Lagrangian techniques. Convergence results are derived and numerical examples are presented, including limit load computations of 2-dimensional structures made of truncated Coulomb material or of Camclay, and the computation of the bearing capacity of a square foundation over a purely coherent soil. (24 refs.)

66478 An experimental determination of the fields of strains and stresses in the elastoplastic range. S.Rautu, E.Leibzon (Ben-Gurion Univ., Beer-Sheva, Israel).
Exp. Mech. (USA), vol.23, no.1, p.99-104 (March 1983).
In order to determine the fields of strains and stresses in the elastic and plastic ranges, for the plane-stress problem, a so-called chromorheological (CHR) model has been utilized. On one side of the model the development of plastic deformations, including the elastoplastic boundaries at any stage of loading, can be either visually observed or recorded on film. On the other side of the model, a birefringent coating is attached from which regular experimental data can be obtained. These data, together with the yield condition, render the possibility of finding the state of stresses at all the points of the known elastoplastic boundaries. The problem of stress in the plastic range is statically determinate. The experiment provides all the data on the boun-

daries, and thereby the field of stresses in the plastic range can be calculated. The field of strains in the elastic and plastic zones can be obtained by the well-known method of photoelasticity. In this way, the relationship between stresses and strains in the plastic zones can be worked out. The effectiveness of the approach on a strip with a central hole has been proven by experimental research. (15 refs.)

66479 Plastic bending of laminated sheets for a given change of thickness. A.D.Matveev.
Izv. VUZ Mashinostr. (USSR), no.2, p.6-9 (1983). In Russian.
Discusses the bending of a laminated sheet into a cylindrical shell, whilst preserving the plane of meridional cross-sections, with an unchanging layer in the material volume and size of sheet in direction of the cylindrical axis. For a given change of the sheet thickness, expressions are derived for the motion, rate of deformation, the actual radii between interfacing layers at which the rate of deformation is zero and radii of surfaces with zero deformation. With these parameters of the sheet motion, it is possible to evaluate the stress and the outer moment and forces, satisfying the equation of equilibrium, and depending also on properties of the sheet material; these properties may be assumed to become strain-hardened with deformation. The materials may be isotropic or anisotropic. (no refs.) *Z.F.V.*

66480 Finite plastic deformation of a circular membrane under hydrostatic pressure. I. Rate-independent behaviour. E.Chater, K.W.Neale (Faculte des Sci. Appl., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).
Int. J. Mech. Sci. (GB), vol.25, no.4, p.219-33 (1983).
The large strain behaviour of a circular membrane under uniform hydrostatic pressure is examined for materials with transversely isotropic plastic properties. Time-independent material response is assumed, and both flow theory and deformation theory of plasticity are considered. A variational principle is first applied to derive the governing equations for the pressurized membrane. It is shown that a special solution previously given by Hill (see Phil. Mag., vol.41, ser.7, p.1133, 1950) for isotropic materials can readily be extended to certain transversely isotropic membranes. A finite element solution based on Hill's extremum principle is then developed to study the influence of anisotropy on the finite deformation behaviour of the membrane. Conditions where localized-necking bifurcations become possible are also discussed. (31 refs.)

66481 Finite plastic deformation of a circular membrane under hydrostatic pressure. II. Strain-rate effects. E.Chater, K.W.Neale (Faculte des Sci. Appl., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).
Int. J. Mech. Sci. (GB), vol.25, no.4, p.235-44 (1983).
For pt.I see ibid., vol.25, no.4, p.219 (1983). The combined effects of material strain-rate sensitivity and anisotropy on the large strain behaviour of pressurized circular membranes are examined. Various rate-dependent constitutive laws based on both flow theory and deformation theory of plasticity are considered for materials with transversely isotropic inelastic properties. The numerical analysis is based on the implementation of a finite element scheme for elastic-viscoplastic materials. A criterion assuring numerical stability and convergence is developed and incorporated in the finite element solutions. (11 refs.)

66482 Flexure of an infinite beam embedded in a Vlazov layer. A.P.S.Selvadurai (Dept. of Civil Engng., Carleton Univ., Ottawa, Ontario, Canada).
Int. J. Mech. Sci. (GB), vol.25, no.4, p.245-50 (1983).
Examines the problem related to the flexure of an infinite beam of finite width embedded in bonded contact with a Vlazov-type elastic layer. In such an elastic layer internal displacement constraints are prescribed a priori. The expressions for the deflection, flexural moment, etc. in the infinite beam are presented in integral form. Numerical results are presented for the flexural moment induced in the embedded beam due to the action of a concentrated line load normal to its length. (9 refs.)

66483 Plastic deformation analysis of strain-rate sensitive materials under plane strain conditions. Y.S.Lee, A.T.Male (Res. & Dev. Center, Westinghouse Electric Corp., Pittsburgh, PA, USA).
Int. J. Mech. Sci. (GB), vol.25, no.4, p.251-63 (1983).
The two-dimensional plane strain equation of plastic flow in accordance with the Levy-Mises constitutive relation is expressed in terms of stream function of complex variables. Expressions for the stress, strain-rate and velocity are derived, assuming the stream function in the forms of both the summation and product of conjugate flow functions, for plastic flow in a nonlinear viscous medium. The plastic states are also derived using a mixed mode solution expressed in terms of non-separable, independent conjugate complex variables. Calculations are made on the effect of variation of the strain-rate sensitivity exponent on the development of a specially instrumented plane strain block indentation test for the rapid determination of the strain-rate sensitivity of real materials. By reducing the results of the indentation of a perfectly plastic material it is found that the contact stress is uniform and the external load is constant. (19 refs.)

66484 Dynamic perforation of viscoplastic plates by rigid projectiles. M.Ravid, S.R.Bodner (Faculty of Mech. Engng., Technion Israel Inst. of Technol., Haifa, Israel).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.577-91 (1983).
A model is formulated for the dynamic perforation. The process is considered to occur in 5 continuously coupled but distinct stages which are amenable to analytical treatment. An essential feature of the analysis is the use of postulated, physically motivated, deformation mechanisms in conjunction with the upper bound theorem of plasticity theory which is modified to include dynamic effects. Special attention is given to the bulging process and effects associated with the later stages. This model is self-contained and capable of predicting that exist velocities of the projectile and the plug. It also determines the bulge and plug shape, provides the force-time history of the process, and describes a number of geometrical features of the treatment and final deformation state of the target plate. (12 refs.)

66485 Bifurcations in axially compressed thick elastic-plastic tubes. A.Kumar (Civil Engng. Dept., Indian Inst. of Technol., Kanpur, India), B.B.Niyogi.
Int. J. Eng. Sci. (GB), vol.21, no.6, p.677-80 (1983).
The stress at which first bifurcation takes place in an axially compressed thick elastic-plastic tube is calculated by utilizing the exact formulation developed by A. Kumar and B.B. Niyogi (Int. J. Engng. Sci., vol.21, p.677, 1983) for elastic tubes. Both axisymmetric and asymmetric modes of bifurcation are considered. (8 refs.)

66486 On the relationship between the logarithmic strain rate and the stretching tensor. M.E.Gurtin, K.Spear (Dept. of Math., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
Int. J. Solids & Struct. (GB), vol.19, no.5, p.437-44 (1983).
The relationship between the stretching tensor $\mathbf{D}$ and the logarithmic (Hencky) strain $\ln \mathbf{V}$, with $\mathbf{V}$ the left stretch tensor is investigated. The simple formula $\mathbf{D}=(\ln \mathbf{V})^{\circ}-\mathrm{sym}(\mathbf{F}\Omega_r\mathbf{F}^{-1})$, which holds for arbitrary three-dimensional motions is established. Here $\mathbf{F}$ is the deformation gradient, $(\ln \mathbf{V})^{\circ}$ is the time derivative of $\ln \mathbf{V}$ measured in a coordinate system which rotates with the left principal strain axes, and Ω_r is the spin of the right principal strain axes. This formula is used to show that $\mathbf{D}=(\ln \mathbf{V})^{\circ}$, (or, equivalently, $\mathbf{D}=(\ln \mathbf{V})^{*}$, the Jaumann derivative of $\ln \mathbf{V}$), if and only if the characteristic spaces of the right stretch tensor $\mathbf{U}$ are constant on any time interval in which the number of distinct principal stretches is constant. Finally, it is shown that the asymptotic approximation $\mathbf{D}=(\ln \mathbf{V})^{*}+O(\epsilon^3)$ holds whenever the displacement gradient $\mathbf{H}$ satisfies $\mathbf{H}=O(\epsilon),\dot{\mathbf{H}}=O(\epsilon)$. (9 refs.)

66487 Stress state for off-axis tension of perforated materials. A.Litewka, E.Rogalska.
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.285-99 (1981). In Polish.
Determines the elastoplastic stress state in specimens of anisotropic materials loaded in the direction which does not coincide with the symmetry axes of the material structure. The anisotropic material was modelled by means of perforated materials with regular triangular and square penetration patterns. The tests enabled the stress distributions to be determined in characteristic sections of the material structure. The stresses determined were homogenized along the pitch of the hole pattern and the disturbances of the uniaxial stress state for off-axis tension of the specimens were estimated. (11 refs.)

66488 Stressed state of a half-plane reinforced by a beam and stringer, with allowance for the development of plastic deformation. Yu.I.Kudishin.
Mech. Solids (USA), vol.17, no.3, p.116-26 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.131-42 (1982).
In a half-plane whose edge is reinforced by a beam loaded by a transverse concentrated force, at the ends of a stringer perpendicular to the edge, a sharp stress concentration is observed, leading to the appearance of plastic zones. The plasticity problem is solved by the method of elastic solutions of Il'yushin (1948). The corresponding elastic problem is solved by the method of linear conjugacy. Computer calculations are given for two examples: the crane girder of an industrial building and the center girder of a heat and electric power plant, manufactured of construction steels. (14 refs.)

66489 Elastic-plastic bending of beams in the process of motion. M.Ya.Brovman.
Mech. Solids (USA), vol.17, no.3, p.140-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.155-60 (1982).
The problem of elastic-plastic bending of beams that perform translational motion along their axis is considered. Conditions of linear distribution of deformation over the thickness of the beam and the model of an ideal elastic-plastic medium are assumed. Experimental findings are presented. (5 refs.)

66490 Defining equations of creep. K.I.Romanov.
Mech. Solids (USA), vol.17, no.3, p.149-51 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.163-5 (1982).
Equations of nonsteady creep are proposed that link the increments of the deformation and stress rates. These equations make it possible to express the loading history. They can readily be integrated in the case of simple loading. An example of the use of the equations is considered. (3 refs.)

66491 A linear integrodifferential equation for viscoelastic rods and plates. K.B.Hannsgen.
Q. Appl. Math. (USA), vol.41, no.1, p.75-83 (April 1983).
It is proved that the resolvent kernel of a certain integrodifferential equation in Hilbert space is absolutely integrable on (O,∞). The equation arises in the linear theory of isotropic viscoelastic rods and plates. (8 refs.)

Progress in boundary element methods. Vol.2 .... See Entry 64606

Damage tensors in continuum mechanics .... See Entry 64679

Methods for computing optimal bounds on deformation in the theory of work-hardening adaptation .... See Entry 66456

Further considerations on the problem of torsion and flexure of prismatical beams .... See Entry 66467

Bending of elastic plates with a regular structure .... See Entry 66472

Minimum-weight thin-walled cylinders of given torsional and flexural rigidity .... See Entry 66474

Buckling of a thin-walled conical shell for axially-symmetric loads beyond the elastic limit .... See Entry 66494

Buckling and post-buckling behaviour of trapezoidal webplates under compression .... See Entry 66495

Pade extensions to ray series methods and analysis of transients in inhomogeneous viscoelastic media of hereditary type .... See Entry 66498

Experimental study of the behavior of perforated plates under static and dynamic loads .... See Entry 66506

The onset of fracture at the tip of a three-dimensional crack in a solid subjected to bending loads .... See Entry 66514

Comparison of finite element solutions with analytical and experimental data for elastic-plastic cracked problems .... See Entry 66517

A slip-line field analysis of the rolling contact problem at high loads .... See Entry 66524

Viscoelastic analysis of glass-to-glass sandwich seals .... See Entry 68579

46.30L Static buckling and instability

66492 On the buckling and imperfection-sensitivity of arches with and without prestress. J.M.T.Thompson, G.W.Hunt (Dept. of Civil Engng., Imperial Coll. London, London, England).
Int. J. Solids & Struct. (GB), vol.19, no.5, p.445-59 (1983).
Shallow, essentially inextensional, simply-supported arches under central point load are used extensively to illustrate the cusped imperfection-sensitivity of an unstable-symmetric bifurcation. Often these are made in the laboratory by simply buckling a straight strut between fixed abutments, and are therefore prestressed. The authors give a concise buckling and post-buckling analysis of such an arch with any degree of prestress, and show that the critical bifurcation load varies linearly with the prestress. The immediate use of the inextensibility greatly simplifies the analysis and leads to neat closed-form solutions which agree extremely well with the limited theoretical and experimental results available from other sources. (15 refs.)

66493 Reduced stiffness axial load buckling of cylinders. J.G.A.Croll, C.P.Ellinas (Univ. Coll. London, London, England).
Int. J. Solids & Struct. (GB), vol.19, no.5, p.461-77 (1983).
A reduced stiffness method is presented for the estimation of lower bounds to the imperfection sensitive general buckling of axially loaded, orthotropically stiffened, elastic cylinders. It predicts many previously inexplicable empirical observations and provides lower bounds to the scatter of available test buckling loads, thus becoming useful as a design tool. (24 refs.)

66494 Buckling of a thin-walled conical shell for axially-symmetric loads beyond the elastic limit. J.Zielnica, M.Kloiek (Politech. Poznanska, Poznan, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.181-201 (1981). In Polish.
The basic equations are derived, and the critical load evaluation method for an elastic-plastic thin-walled conical shell is presented. It is assumed that the shell is subjected to the following, external, axially symmetric loads: lateral uniform pressure, external uniform hydrostatic pressure, longitudinal compressive force, acting along the shell generatrix. Taking into account Shanley's concept, for each case the relations are given enabling one to find critical loads according to both basic plasticity theories (incremental and total strain). The material's compressibility and linear-type stress-strain characteristic are taken into account. The problem is solved by the orthogonalization method. Numerical results are given in diagrams. (6 refs.)

66495 Buckling and post-buckling behaviour of trapezoidal webplates under compression. R.Gradzki (Politech. Lodzka, Lodz, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.203-15 (1981). In Polish.
The approximate solution of the title problem is derived on the basis of nonlinear differential equations of thin plates with initial deflection. The solution of these equations is based on the Bubnov-Galerkin method. The results of numerical calculations are presented in diagram form. Theoretical results are verified by experiments. (14 refs.)

Discrete and non-discrete mixed methods applied to eigenvalue problems of plates .... See Entry 66457

Bifurcations in axially compressed thick elastic-plastic tubes .. See Entry 66485

In-plane shear test of thin panels .... See Entry 66535

46.30M Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks

(see also 43.40 Mechanical vibrations and shock)

66496 Out-of-plane vibrations of curved bars with varying cross-section. K.Suzuki, T.Kosawada, S.Takahashi (Yamagata Univ., Yonezawa, Japan).
Bull. JSME (Japan), vol.26, no.212, p.268-75 (Feb. 1983).
The out-of-plane free vibrations of a curved bar of which the cross-section varies are analyzed by using the classical theory. The equations of vibration and the boundary conditions are determined from the stationary conditions of the Lagrangian of the bar in a period of vibration. The equations of vibrational are solved exactly in a series solution. As numerical examples, the natural frequencies and the mode shapes of symmetric elliptic arc bars with both clamped ends and with both simply supported ends are obtained. And the variations of the natural frequencies and the mode shapes for various cross-sections are investigated. (13 refs.)

66497 Coupled *P* and *SV* waves propagating in spherical elastic layers. Exact solution and interpretation. A.Gerard (Lab. de Mecanique Theorique, Univ. Pierre et Marie Curie, Paris, France).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.617-25 (1983).
The propagation of coupled P and SV waves emitted by a source point placed outside a given finite set of concentric elastic spherical layers is studied. It is shown that the system of boundary conditions of this pattern is a linear combination of the boundary conditions of the simpler problem of reflection-refraction phenomenon of a wave at a spherical surface. From this result the exact solution follows for all regions of the multilayered structure without using Cramer's technique. This solution is written as a series of which each element is interpreted directly in terms of multiple reflection-refraction. It gives a simple explanation for triggering of resonance phenomena. The solution contains many particular bases of which several are investigated. (17 refs.)

66498 Pade extensions to ray series methods and analysis of transients in inhomogeneous viscoelastic media of hereditary type. D.W.Barclay, T.B.Moodie, R.J.Tait (Dept. of Math., Univ. of Alberta, Edmonton, Alberta, Canada).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.663-73 (1983).
It is demonstrated that wavefront expansions for the analysis of transient phenomena are far from adequate when numerical information back of the wavefront is required. However, by employing Pade approximants together with ray series methods, one can obtain directly and greatly extend the range of validity of these expansions. The procedure, which is straightforward and requires very little computing time, is applied to a non-trivial problem involving impact-generated shear transients in inhomogeneous viscoelastic media whose stress-strain laws are given in integral form. For a special combination of the material parameters an exact solution is recovered and used to check the validity of the approximate Pade-extended wavefront solution. The results from the extended inversion scheme for Laplace solution are also compared with numerical solutions obtained using Bellman's approximate inversion scheme for Laplace transforms. A further advantage of the authors' approach is that, unlike transform techniques, it does not depend upon being able to find tabulated special function equations for the transformed dependent variables. (11 refs.)

66499 Vibrations of cantilevered doubly-curved shallow shells. A.W.Leissa, J.K.Lee, A.J.Wang (Dept. of Engng. Mech., Ohio State Univ., Columbus, OH, USA).
Int. J. Solids & Struct. (GB), vol.19, no.5, p.411-24 (1983).
Vibrational characteristics are determined for a previously unsolved class of problems, that of doubly-curved shallow shells having rectangular planforms, clamped along one edge and free on the other three. The solution procedure uses the Ritz method with algebraic polynomial trial functions. Convergence studies are made, and accurate frequencies and contour plots of mode shapes are presented for various curvature ratios, including spherical, circular cylindrical and hyperbolic paraboloidal shells. Particular emphasis is given to the effect of adding spanwise curvature to shells having chordwise curvature; numerous published references already exist for the case of zero spanwise curvature. The effects of changing aspect ratio, thickness ratio and Poisson's ratio are also studied. (14 refs.)

66500 Simplified equations and solutions for the vibration of orthotropic cyclindrical shells. W.Soedel (School of Mech. Engng., Purdue Univ., West Lafayette, IN, USA).
J. Sound & Vib. (GB), vol.87, no.4, p.555-66 (22 April 1983).
Starting with Love type equations of motion for orthotropic circular cylindrical shells, the theory is simplified by assumptions similar to those in the Donnell-Mushtari-Vlasov development for isotropic shells. Closed form solutions for simply supported cases are then obtained. Results of two example cases are compared with finite element results and are shown to agree well. It is argued that this simplified approach allows easy assessment of the influence of design parameter changes. (14 refs.)

66501 Vibration analysis of Mindlin plates. N.Ganesan (Dept. of Appl. Mech., Indian Inst. of Technol., Madras, India), M.S.Dhotarad.
J. Sound & Vib. (GB), vol.87, no.4, p.643-5 (22 April 1983).
Natural frequencies of flexural vibrations of isotropic plates based on the classical thin plate theory can be in significant error for other than the lower modes of truly thin plates. To account for the effects of transverse shear and rotary inertia, a small number of improved thick plate theories have been developed. One of them is the Mindlin plate theory. The parameters involved in the problem are the deflection w, and the cross sectional rotations ψ_x and ψ_y. In the Rayleigh-Ritz method, trial functions are required for the spatial variation of each of the three quantities w, ψ_x, and ψ_y and these were taken by Dawe and Roufaeil [1980] to be series of products of beam functions. As the functions are little more complicated than classical beam functions it is of some interest to compare results obtained by using the simpler classical beam functions for the solution of the Mindlin plate problem with those obtained by Dawe and Roufaeil. (9 refs.)

66502 Sensitivity of solutions of linear equation for a vibrating membrane to variation of equation coefficients. R.Gutowski (Politech. Warszawska, Warsaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.375-84 (1981). In Polish.
The sensitivity of solution has been tested by the sensitivity function, for which a partial differential equation has been derived. A properly established distance between the null solution to this equation and the solution of the differential equation of sensitivity has been used to estimate the double integral of the square of the sensitivity function. The estimation service later to investigate the variation with time of the double integral and permitted one to determine its limitations and convergence to zero as $t \rightarrow \infty$. (6 refs.)

66503 Transverse vibrations of a beam forced by discrete material system. S.Kasprzyk, R.Ziernicki (Politech. Karkowska, Krakow, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.423-33 (1981). In Polish.
A mathematical model is developed for the analysis of the dynamic response of a beam on which a discrete system moves with constant velocity. (6 refs.)

66504 Hamilton's law applied to the nonstationary elastodynamics of plates. C.D.Bailey (Dept. of Aeronaut. & Astronaut. Engng., Ohio State Univ., Columbus, OH, USA).
Mech. Res. Commun. (GB), vol.9, no.6, p.381-9 (Nov.-Dec. 1982). [received: March 1983]
Hamilton's law of varying action is applied to obtain direct analytical solutions to the non-stationary, non-conservative and conservative motion of plates with prescribed initial conditions. Analytical solutions are generated directly from the law of varying action without any use of or reference to the theory of differential or integral equations. Calculated results are compared to experimental results for two separate sets of initial conditions. (21 refs.)

66505 Waves in weakly anisotropic media. Yu.A.Rossikhin.
Mech. Solids (USA), vol.17, no.3, p.146-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.160-2 (1982).
An anisotropic medium is considered whose elastic moduli differ only slightly from the elastic coefficients of some isotropic material. A medium of this type is called weakly anisotropic. In this medium the behavior of body waves that arise when a load is suddenly applied to the boundary of a spherical cavity is investigated. The perturbation method is employed which enables one to obtain in a first approximation a number of features of wave propagation in crystals. (4 refs.)

66506 Experimental study of the behavior of perforated plates under static and dynamic loads. I.N.Preobrazhenskii, E.D.Skurlatov.
Mech. Solids (USA), vol.17, no.3, p.155-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.168-71 (1982).
Presents the findings of an experimental study of the behavior of circular perforated plates under the action of a static load or load of shock-wave type applied to the lateral surface. The plates were made both of plastic compounds of type AMG-6 and of brittle materials such as polymethyl methacrylate, celluloid, and beryllium. Analysis of test results yielded empirical relationships that simplify the calculation of the static breaking load and that also permit an evaluation of the dynamic response of perforated plates acted upon by shock waves. Aspects of the behavior of brittle and plastic plates in collision with solid particles moving at velocities 100-2500 m/sec are discussed, as well as aspects of the behavior of particle-damaged plates under subsequent static and dynamic loading. (4 refs.)

66507 Density of free vibration frequencies for a thin anisotropic shell made of anisotropic layers. G.R.Gulgazaryan, V.B.Lidskii.
Mech. Solids (USA), vol.17, no.3, p.159-62 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.171-4 (1982).
The density of free vibration frequencies is found for a thin shell of arbitrary outline, made up of anisotropic shells. (11 refs.)

Exact solutions for a certain hyperbolic 2-conservation law .... See Entry 64684

Wave equation Green's function approximations for nearly-planar half-planes and half-spaces .... See Entry 64694

Discrete and non-discrete mixed methods applied to eigenvalue problems of plates .... See Entry 66457

Dynamic perforation of viscoplastic plates by rigid projectiles .... See Entry 66484

Experimental technique for measurement of stress-acoustic coefficients of Rayleigh waves .... See Entry 66534

Free vibrations of a piezoelectric layer of hexagonal (6 mm) class .... See Entry 68131

46.30N Fracture mechanics, fatigue, and cracks

66508 Interaction of cracks in elastic media. M.Matczynski, M.Sokolowski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.1, p.89-104 (1982).
The problem of static interaction of cracks in elastic bodies is considered from the point of view of the classical fracture analysis, and of the general theory of defects in solids. Effective formulae for the interaction forces are derived by means of the path-independent integrals. The results are illustrated by examples of approximate analysis of the problem of an infinite elastic body containing two parallel cracks and subject to antiplane strain. (12 refs.)

66509 Axisymmetric problem of a flat interface annular crack between an elastic layer and a half-space. K.Kaneko (Yanagicho Works, Toshiba Corp., Kawasaki, Japan), Y.Shindo, A.Atsumi.
Bull. JSME (Japan), vol.26, no.212, p.202-6 (Feb. 1983).
The singular stress problem for an elastic layer bonded to a half-space with different material properties is considered. It is assumed that the bimaterial interface contains a flat annular crack of which the surfaces are subjected to known tractions. The axisymmetric elastostatic problem is first reduced to

that of solving a system of singular integral equations of the second kind. By the way of expanding the unknown function into Jacobi polynomials, the singular integral equations are further reduced to the infinite system of linear algebraic equations for determining the unknown coefficients. Numerical examples are given for an aluminum-epoxy and an aluminum-steel material combination. The stress-intensity factor with the ratio of the inner radius to the outer one of the crack is shown graphically for several values of layer thickness. (7 refs.)

66510 Some remarks on elastic fracture mechanics. P.Destuynder (Div. Mecanique Theorique et Calcul des Structures. EDF, DER, Clamart, France), M.Djaoua, S.Lescure.
J. Mec. Theor. & Appl. (France), vol.2, no.1, p.113-35 (1983). In French.
A thermodynamical approach to the propagation law in elastic media is given. From a particular choice of an energy dissipation potential, some propagation laws are deduced corresponding to particular loading cases. Finally a new computational method for the energy release rate is suggested and discussed from a computational point of view. (25 refs.)

66511 Dynamic crack curving—a photoelastic evaluation. M.Ramulu, A.S.Kobayashi (Dept. of Mech. Engng., Univ. of Washington, Seattle, WA, USA).
Exp. Mech. (USA), vol.23, no.1, p.1-9 (March 1983).
A dynamic-crack-curving criterion, which is valid under pure Mode I or combined Modes I and II loadings and which is based on either the maximum circumferential stress or minimum strain-energy-density factor at a reference distance of r_o from the crack tip, is verified with dynamic-photoelastic experiments. Directional stability of a Mode I crack propagation is attained when $r_0=1/128\pi[(K_I/\sigma_{0x})^2V_0^2(C,C_1,C_2)]>r_c$, where $r_c=1.3$ mm for Homalite-100 used in the dynamic-photoelastic experiments. (34 refs.)

66512 Displacement measurements around cracks in three-dimensional problems by a hybrid experimental technique. C.W.Smith, D.Post, G.Hiatt, G.Nicoletto (Dept. of Engng. Sci. & Mech., Virginia Polytech. & State Univ., Blacksburg, VA, USA).
Exp. Mech. (USA), vol.23, no.1, p.15-20 (March 1983).
Diffraction gratings were applied to slices taken from three-dimensional stress-frozen models of bodies with cracks. The slices were then annealed to relax the reversible strains and moire interferometry was used to determine the deformation of the slice. A virtual reference grating of 1200 *l*/mm (30000 *l*/in) was used to provide the required high sensitivity. The moire pattern in the LEFM (linear-elastic fracture-mechanics) zone was photographed with 20x magnification. Results were compared with those obtained photoelastically. (17 refs.)

66513 Internal energy dissipation in metals subjected to cyclic stresses with varying amplitudes. A.N.Artamonov, D.N.Reshetov, R.M.Chatynyan.
Izv. VUZ Mashinostr. (USSR), no.2, p.12-15 (1983). In Russian.
Describes a procedure for investigating rules of build-up of fatigue faults by a method of continuous recording of the deformation of a sample. Experimental results are presented in the form of graphs of the energy dissipated during a cycle, as a function of the loading cycles, for fixed and mean equiprobable loading conditions. Tests with identical samples were performed in a quantity adequate for statistical processing of the data. (9 refs.) *Z.F.V.*

66514 The onset of fracture at the tip of a three-dimensional crack in a solid subjected to bending loads. E.Smith (Dept. of Metall., Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.627-33 (1983).
The conditions for the extension of a 3-dimensional crack in a solid subjected to bending loads are examined for the case where the ligament has fully yielded. The main conclusion, for this 3-dimensional problem, is that caution should be exercised when applying the well-known J integral relation: $J=(\partial M_p/\partial A)\phi_p$ where M_p is the plastic limit moment and ϕ_p is the plastic rotation. (4 refs.)

66515 Three-dimensional curved crack in an elastic body. V.Sladek, J.Sladek (Inst. of Construction & Architecture, Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Int. J. Solids & Struct. (GB), vol.19, no.5, p.425-36 (1983).
The boundary integral equations, which give the relation between the crack opening displacement and traction on the surface of a crack embedded in an infinite isotropic elastic body are formulated. The integral equations are transformed into spherical and cylindrical coordinates in the cases of cracks curved in the shape of spherical and cylindrical surfaces respectively, so that these boundary integral equations may be converted into a system of algebraic equations by the boundary element method. The dependence of stress-intensity factors on the curvature of crack has been numerically calculated for the spherical crack with circular contour under a constant load. (12 refs.)

66516 Elastic analysis of torsion crack problems of a bar with ring segment sections. Chen Yi-Zhou (Div. of Solid Mech., North-Western Polytech. Univ., Xian, China), Chen Yi-Heng.
Int. J. Fract. (Netherlands), vol.22, no.1, p.3-14 (May 1983).
Torsion crack problems of a bar with ring segment sections are discussed. The procedure utilized consists of the following three steps: (1) using the conformal mapping technique, (2) using the harmonic function continuation technique, (3) using the compliance method. The procedure used belongs to an indirect one with respect to calculation of K_3 values. All the numerical results concerning the torsional rigidity and K_3 are given. (11 refs.)

66517 Comparison of finite element solutions with analytical and experimental data for elastic-plastic cracked problems. M.H.Bleackley, A.R.Luxmoore (Dept. of Civil Engng., Univ. Coll. of Swansea, Swansea, Wales).
Int. J. Fract. (Netherlands), vol.22, no.1, p.15-39 (May 1983).
Nonlinear finite element results from a round robin are compared with empirical and experimental data obtained for three types of geometries: compact specimen, three-point bend specimen and a center-cracked panel subject to uniaxial loading. The solution parameters to be compared in various forms are: applied load, clip gauge displacement, Rice J-integral (with no limit placed on method of calculation), K_I, crack opening profiles and plastic zone development. (15 refs.)

66518 Energy release rate techniques for combined thermo-mechanical loading. B.R.Bass, J.W.Bryson (Heavy-Section Steel Technol. Program, Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Int. J. Fract. (Netherlands), vol.22, no.1, p.R3-7 (May 1983).
Nonlinear methods in computational fracture mechanics have focused increasingly on energy release rate techniques for computing stress intensity parameters of crack configurations. The technique of deLorenzi (1980) has been applied in the heavy-section steel technology (HSST) program to 3-D linear elastic and elastic-plastic models of plates and cylinders containing straight-through and curved finite crack configurations. For brevity, only the essential alterations to deLorenzi's argument are treated here. (7 refs.)

66519 Effect of non-uniform pressure on the extension of an external crack. M.Maiti, R.Paramguru (Dept. of Math., Indian Inst. of Technol., Kharagpur, India).
Int. J. Fract. (Netherlands), vol.22, no.1, p.R15-19 (May 1983).
Considers non-uniform loading condition over the surface of an external crack and thereby determine the effect of such loading on the extension of an external crack. (9 refs.)

66520 The inclined crack under biaxial and uniaxial loading. P.S.Theocaris, A.C.Chrysakis (Dept. of Theoretical & Appl. Mech., Athens Nat. Tech. Univ., Athens, Greece).
Int. J. Fract. (Netherlands), vol.22, no.1, p.R25-9 (May 1983).
It has been observed that for an inclined crack under biaxial loading at infinity (σ_1, k, β) the coefficient of its singular solution, known as the stress intensity factor and being a complex number, can be expressed by means of two real parameters. As such the authors choose the stress at infinity σ and the inclination α of a uniaxially loaded inclined crack, thus establishing an equivalence between the two configurations. This equivalence is shown to fail for those combinations of k and β corresponding to the case of mode II deformation. (7 refs.)

66521 Plane-normal separation crack for the case of linear linkages between its surfaces. E.I.Shifrin.
Mech. Solids (USA), vol.17, no.3, p.70-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.80-6 (1982).
Considers a plane crack in an elastic space. It is assumed that normal opening forces that are symmetrical relative to the plane of the crack are applied to the crack surfaces, and that there are linkages between the surfaces. It is further assumed that the effect of the linkages can be taken into account by normal forces that close the crack and are proportional to the aperture. An example can be provided by a material with a crack whose surface is intersected by a large number of elastic reinforcing elements of small dimensions. In this case the forces that close the crack arise as a result of adhesion between the material and the reinforcing elements. A comparison theorem is proved with respect to the parameter characterizing the linkages. By means of these assertions, estimates are obtained for the stress intensity coefficients under uniform loads in terms of the geometrical characteristics of the crack region. Estimates for the crack volume are given that are analogous to those obtained in the problem without linkages. A numerical solution is provided for the problem of a penny-shaped crack under uniform loads and for various characteristics of the linkages. (8 refs.)

66522 Dynamic fracture mechanics. R.S.J.Corran.
Report OUEL-1421/82, Univ. Oxford, England (July 1982), 70 pp.
The elastic analysis of the dynamic crack is presented, including the crack tip stress field, the energy flux into the crack tip, the energy balance criterion, and the problem of crack arrest. Techniques for measuring initiation toughness are reviewed, including notched bar tests, small CTS (compact tension specimen) testing, and the notched cylinder test. Crack arrest testing is discussed including dynamic analysis of a double cantilevered beam specimen. (41 refs.)

Progress in boundary element methods. Vol.2 ....See Entry 64606

Prefailure scheme for composites near holes ....See Entry 66470

Experimental study of the behavior of perforated plates under static and dynamic loads ....See Entry 66506

Transient response of a central crack to a tensile pulse ....See Entry 66536

A mechanism of void growth in the region of the plastic zone ahead of a crack-tip ....See Entry 66979

Elastic moduli of a cracked body ....See Entry 67086

46.30P Friction, wear, adherence, hardness, mechanical contacts

66523 Explicit equations for the stresses beneath a sliding spherical contact. G.M.Hamilton (Dept. of Engng., Univ. of Reading, Reading, England).
Proc. Inst. Mech. Eng. Part C (GB), vol.197, p.53-9 (March 1983).
Explicit formulae are developed for the stresses beneath a sliding, normally loaded Hertzian contact. As friction rises a region of impending failure develops in the back edge of contact. (11 refs.)

66524 A slip-line field analysis of the rolling contact problem at high loads. H.Petryk (Inst. of Fundamental Technol. Res., Acad. of Sci., Warsaw, Poland).
Int. J. Mech. Sci. (GB), vol.25, no.4, p.265-75 (1983).
An analysis of the steady rolling of a rough rigid cylinder over the surface of a rigid-perfectly plastic solid is presented. An exact slip-line field solution is investigated by using some recently developed techniques. It is shown that the solution is not uniquely defined and infinitely many complete solutions can be constructed for given boundary conditions. The numerical results show interesting variations of the deformation pattern and of rolling resistance at high loads. The limits are predicted to the magnitudes of the applied load and braking torque for which the steady rolling is possible. (22 refs.)

66525 Contact between an elastically supported circular plate and a rigid indenter. L.M.Keer, G.R.Miller (Northwestern Univ., Technol. Inst., Evanston, IL, USA).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.681-90 (1983).
The axially symmetric problem of a finite circular plate loaded at its center by a smooth, rigid punch is solved by superposing an infinite layer elasticity solution with a pure bending plate theory solution. The problem is reduced to dual integral equations, which are further reduced to a single Fredholm integral equation of the second kind. The Fredholm equation is numerically solved and the results are used to compute contact stresses under the indenter as well as the overall load-deflection behavior. The problem is formulated to model a partially fixed edge around the plate's perimeter, and calculations are carried out for the limiting cases of simple supports and complete fixity. Various ratios of plate diameter to plate thickness are studied, and the results are compared to both Hertzian contact theory and standard plate theory. (5 refs.)

66526 Nature of substructural hardening. N.A.Koneva, E.V.Kozlov (Civil-Engng. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.681-91 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.3-14 (Aug. 1982). [received: April 1983]
This is a reworked version of a review paper that the authors presented at the first conference on substructural hardening (mechanical-thermal working and Substructural Hardening of Metals Conference, Kiev, May 19-21, 1981), and contains a classification of substructures, important characteristics of mechanisms for its formation, and an estimate of the role of the component substructures in the formation of flow stress. The experimental facts, on which the concepts presented are based, are taken from work that they have performed with co-workers. The materials used for the investigations were austenitic

manganese steel, disordered and ordered nickel and palladium-iron and copper-gold alloys. Thus, the problems examined in this paper and the results obtained are limited to FCC materials. (27 refs.)

Progress in boundary element methods. Vol.2 .... See Entry 64606

Deformation of an elastic plane reinforced by a periodic system of nonperiodically loaded oblique semi-infinite stringers .... See Entry 66471

Flexure of an infinite beam embedded in a Vlazov layer .... See Entry 66482

Dynamic perforation of viscoplastic plates by rigid projectiles .... See Entry 66484

Transient response of a central crack to a tensile pulse .... See Entry 66536

The influence of hardness on the resistance to wear by paper .... See Entry 68664

Second-grade fluid film lubrication in Hertzian contacts with reference to synovial joints .... See Entry 68977

46.30R Measurement methods and techniques

(see also 07.10 Mechanical instruments and techniques, 81.70 Materials testing)

66527 Optical heterodyne measurement of vibration phase. Y.Oshida, K.Iwata, R.Nagata (Dept. of Mech. Engng., Univ. of Osaka Prefecture, Osaka, Japan).
Opt. & Lasers Eng. (GB), vol.4, no.2, p.67-79 (1983).
An optical heterodyne system for measuring a vibration phase, which uses a frequency-shifted and phase-modulated reference beam, is proposed. This system is applicable to a rough surface. By using the light scattered by a standard vibrating point on the object surface as the reference beam (local reference beam technique), effects of the uniform displacement of the object can be eliminated, i.e. only the vibration component is detected with no sensitivity to the uniform displacement. Preliminary experiments demonstrate the validity of the theory. (7 refs.)

66528 Interferometric analysis for small rotation. Jacob Wen-Kuang Huang, Song Yu-Dong (Phys. Dept., Towson State Univ., Baltimore, MD, USA).
Opt. & Lasers Eng. (GB), vol.4, no.2, p.81-90 (1983).
Both holographic interferometry and speckle interferometry are used to analyse small rotation. The experimental set-up and results are presented. A brief comparison of the two methods is also given. (4 refs.)

66529 Experimental study of inelastic strain patterns in a model of a tube-plate ligament using an interferometric moire technique. C.A.Walker, J.McKelvie, A.McDonach (Centre for Industrial Innovation, Univ. of Strathclyde, Glasgow, Scotland).
Exp. Mech. (USA), vol.23, no.1, p.21-9 (March 1983).
A sensitive moire interferometer has been developed for measuring elastoplastic strain distributions. No rigid connection with the specimen was required, and the fringe patterns could be seen by eye as loading progressed. The system has been applied to the measurement of strain patterns in a stainless-steel model of a tube-plate ligament. The model was loaded in tension and in bending, with the eventual aim of measuring strain-intensification factors which could be used as basic design data. (8 refs.)

66530 Epon 828 epoxy: a new photoelastic-model material. R.B.Agarwal, L.W.Teufel (Dept. of Mech. Engng., San Jose State Univ., San Jose, CA, USA).
Exp. Mech. (USA), vol.23, no.1, p.30-5 (March 1983).
The photoelastic properties of Epon 828 are discussed. The epoxy is evaluated experimentally for its time-edge effect, optical creep, stress-optic relations, and mechanical properties at room and elevated temperatures. Epon 828 is extremely clear, has good transparency, and can be used for photoelastic stress analysis at room and elevated temperatures. It has a low-fringe constant at room temperature as will as at elevated temperatures coupled with a high critical modulus of elasticity. Epon 828 can easily be cast stress-free and has relatively small amounts of optical and mechanical creep. The machining characteristics of Epon 828 are excellent and it cements easily with itself and other epoxy materials. (6 refs.)

66531 An introduction to dynamic photoelasticity. Discussion. J.A.Clark, A.J.Durelli (Dept. of Mech. Engng., Catholic Univ. of America, Washington, DC, USA).
Exp. Mech. (USA), vol.23, no.1, p.42-8 (March 1983).
J.W. Dally's review of several systems for recording photoelastic fringe patterns which change rapidly in time identifies many of the challenges and recent successes of one active research area in dynamic photomechanics. His presentation also outlines techniques for determining stresses from photographs of dynamic fringe patterns in a few particular cases, indicates some successful applications of photoelastic methods and addresses the difficult problem of categorizing elastodynamic phenomena in a manner most relevant to researchers in photoelasticity. However, the discussers feel that this article, if intended as an introduction to the entire field of dynamic photoelasticity, would benefit from a broader view of the subject. The authors offer the following comments in the spirit of complementing the original article with discussions of several other aspects of dynamic photoelasticity which the authors feel are at least equally important. Ambiguities in this article such as the confusion between edge waves on a thin plate and Rayleigh waves require that the discussion starts with a presentation of some fundamental concepts concerning the distinction between waves propagating in large bodies (extended media) and waves propagating in plates (bounded media). (22 refs.)

66532 On stress analysis of anisotropic composites through transmission optical patterns: isochromatics and isopachics. K.A.Jacob, V.Dayal, B.Ranganayakamma (Structures & Materials Div., Aeronautical Dev. Establ., J.B. Nagar, Bangalore, India).
Exp. Mech. (USA), vol.23, no.1, p.49-54 (March 1983).
A real-time holographic interferometry technique is suggested for recording the isopachic patterns corresponding to transparent anisotropic composites. The isochromatic and isopachic patterns are obtained for a transparent glass-epoxy composite disk with a central hole subjected to diametral compression. A method is suggested for interpreting the optical data and to obtain the separate values of stress components. Its application is demonstrated. (14 refs.)

66533 A method of three-dimensional strain measurement on non-ideal objects using holographic interferometry. J.L.Goldberg (CSIRO Div. of Appl. Phys., Sydney, Australia).
Exp. Mech. (USA), vol.23, no.1, p.59-73 (March 1983).
Holographic interferometry has been applied to determine the components of tensile, compressive and shear strain in the surface layer of a non-ideal object subjected to high values of stress. The method consists of determining the three components of the vector displacement at a sufficient number of discrete points on the surface of the object. Functions in the form of truncated power series are fitted to the fringe order-distance data using the method of least squares. Interpolation of these functions is then carried out to obtain the fringe-order numbers at closely spaced equal intervals. The displacement in each interval is calculated and the displacement-distance relationship is then numerically differentiated to obtain strain. Components of stress at a particular point are then estimated by multiplying the strain value by the appropriate modulus. (12 refs.)

66534 Experimental technique for measurement of stress-acoustic coefficients of Rayleigh waves. K.Jassby (Faculty of Engng., Tel-Aviv Univ., Tel-Aviv, Israel), D.Kishoni.
Exp. Mech. (USA), vol.23, no.1, p.74-80 (March 1983).
Two stress-acoustic coefficients, K_1 and K_2, are required to determine the state of biaxial surface stress from ultrasonic Rayleigh-wave velocity of time of flight measurements in elastic, initially isotropic solids. An experimental technique is described for the precise measurement of these two coefficients in uniaxially stressed test specimens. The technique is applied to aluminum 2024-T351 and 6061-T651 alloys. The influence on measurement results of various parameters such as material anisotropy and temperature is considered. (14 refs.)

66535 In-plane shear test of thin panels. G.L.Farley, D.J.Baker (US Army Res. & Tech. Labs., Langley Res. Center, Hampton, VA, USA).
Exp. Mech. (USA), vol.23, no.1, p.81-8 (March 1983).
Efficient application of thin-gage composite materials to helicopter fuselage structures necessitates that the materials be designed to operate at loads several times higher than initial buckling load. Methods are required to accurately measure and predict the response of thin-gage composites when subjected to these loads. This paper presents the results of an analytical and experimental study of the behavior of thin-gage composite panels subjected to in-plane shear loads. Finite-element stress analyses were used to aid in the design of an improved shear fixture that minimizes adverse corner stresses and tearing and crimping failure-modes characteristic of commonly used shear fixtures. Tests of thick buckle-resistant aluminum panels and thin aluminum and composite panels were conducted to verify the fixture design. Results of finite-element stress and buckling analyses and diagonal-tension-theory predictions are presented. Correlation of experimental data with analysis indicated that diagonal-tension theory can be used to predict the load-strain response of thin composite panels. (5 refs.)

66536 Transient response of a central crack to a tensile pulse. A.A.Sukere, W.N.Sharpe,Jr. (Dept. of Mech. & Aerospace Engng., Univ. of Missouri-Columbia, Independence, MO, USA).
Exp. Mech. (USA), vol.23, no.1, p.89-98 (March 1983).
Studies the opening displacement of a central electromachined slot in a thin aluminum plate subjected to an elastic tensile pulse. The tensile pulse was generated by an impact apparatus, and in-plane displacements were measured by interferometric techniques. Comparison with existing analytical and finite solutions was good for short times. (27 refs.)

66537 Identification of isochromatic fringes. A.J.Durelli, A.Shukla (Dept. of Mech. Engng., Univ. of Maryland, College Park, MD, USA).
Exp. Mech. (USA), vol.23, no.1, p.111-19 (March 1983).
In simple cases of static-photoelastic analysis, the numbering or the isochromatic fringes does not present unusual difficulties. In more complex cases, in particular wave propagation, the problem may be so difficult that few investigators attempt the analysis. The authors present guidelines to number the isochromatic fringes. Advantage is taken of some topological properties as well as of the time and space derivatives of these isochromatic fringes. Several examples are discussed to illustrate the use of the guidelines. It is observed that under most conditions the guidelines are sufficient to number the whole field of isochromatics on photographs taken with the commonly used monochromatic light. (10 refs.)

66538 Nondestructive residual-stress measurement in a wide-flanged rolled beam by acoustoelasticity. H.Fukuoka, H.Toda, H.Naka (Faculty of Engng. Sci., Osaka Univ., Osaka, Japan).
Exp. Mech. (USA), vol.23, no.1, p.120-8 (March 1983).
Acoustoelasticity makes use of stress-induced acoustic-birefringent effects. It gives stress distributions averaged through the thickness of a specimen. This technique is attractive because it does not require a transparent plastic model as photoelasticity does. However, much should be done before this method is established as a standard nondestructive technique of stress analysis. The most important among them is to separate stress-induced birefringence from that introduced by texture structure. For special cases, such as axisymmetric stress distributions and when a stress-free region is known a priori, residual-stress distributions can be evaluated nondestructively. In this paper, the authors measured residual-stress distribution in a wide-flanged rolled beam by using a recently developed T-type transducer. The results were compared to those obtained from conventional destructive methods. (3 refs.)

Ultrasonic-resonance method of determining transverse dimensions for fine fibers and wires .... See Entry 64886

Measuring procedure for transverse dimensions of fine rods and wires by the ultrasonic-resonance method .... See Entry 64887

A microcomputer-controlled automatic inverted torsion/flexure pendulum and realtime data processing system for low-frequency internal friction studies .... See Entry 64901

A new type of laser probe .... See Entry 66431

An approximate method of orthotropic photoelastic analysis ... See Entry 66466

An experimental determination of the fields of strains and stresses in the elastoplastic range .... See Entry 66478

Dynamic crack curving—a photoelastic evaluation .... See Entry 66511

Displacement measurements around cracks in three-dimensional problems by a hybrid experimental technique .... See Entry 66512

Toward a pure shear specimen for K_{IIc} determination .... See Entry 68719

Fracture toughness tests on an aluminium alloy using a chevron notch bend specimen .... See Entry 68720

A facility for precise measurement of mechanical properties at elevated temperatures .... See Entry 68721

A plane strain tensile apparatus .... See Entry 68722

Confidence limits of stress values measured by X-ray diffraction .... See Entry 68724

46.60 RHEOLOGY OF FLUIDS AND PASTES

66539 Analysis of the Rouse model in extensional flow. I. A general solution of the distribution function in an arbitrary flow field. D.H.King, D.F.James (Dept. of Mech. Engng., Univ. of Toronto, Toronto, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.7, p.4743-8 (1 April 1983).
The statistical mechanics of the Rouse model for a macromolecule are analyzed by the use of Laplace transform techniques. The analysis leads to the known constitutive equation for a dilute solution of Rouse-type molecules and to the general solution for the distribution function ψ in an arbitrary flow field. The form of the general solution is different from that presented by Lodge and Wu (1971) and appears to be easier to use. In particular, the new solution makes it straightforward to calculate average molecular quantities like deformation because there is a simple relation between the quantity and the Laplace transform of ψ. This capability is shown by calculations of molecular size, shape, and elastic storage for a general flow field. The deformation of a submolecule unit is also calculated for an assessment of the validity of the Rouse model. The assessment shows that the model is valid per se even at high rates of pure extension. (8 refs.)

66540 Analysis of the Rouse model in extensional flow. II. Stresses generated in sink flow by flexible macromolecules and by finitely extended macromolecules. D.H.King, D.F.James (Dept. of Mech. Engng., Univ. of Toronto, Toronto, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.7, p.4749-54 (1 April 1983).
For pt.I see ibid., vol.78, no.7, p.4743 (1983). Stresses generated by a solution of Rouse macromolecules in planar and axisymmetric sink flow were analyzed by solving the momentum equation together with the constitutive relation corresponding to the Rouse model (i.e., the generalized converted Maxwell equation). The results show that the additional normal stress in the radial direction is of order $[\eta]c$ when compared with the corresponding Newtonian viscous stress. However, in the high Reynolds number range where sink flow conditions are valid, the additional stress must be compared with inertial stresses, and in that case the results show that the ratio of non-Newtonian to Newtonian hydrodynamic stresses is of order $[\eta]c/\mathrm{Re}$, where Re is the Reynolds number. Since experimental data exceed this small ratio by two orders of magnitude, a new molecular model was developed to accommodate limited molecular extension. The model presumes that, in a converging flow, a molecule initially deforms as a Rouse molecule and then its configuration is frozen after a certain amount of extension. This 'frozen-necklace' model consequently provides an estimate of hydrodynamic effects caused by finite extension, as might be created by intramolecular entanglements. Non-Newtonian stresses predicted by the model are compared with available data for strictly dilute solutions and agree to the same order of magnitude. (14 refs.)

66541 Binary blends of monodisperse polymers: use of a kinetic network model for nonlinear shear stress predictions in entangled polymer fluids. T.Y.Liu, D.S.Soong, M.C.Williams (Dept. of Chem. Engng., Univ. of California, Berkeley, Berkeley, CA, USA).
J. Rheol. (USA), vol.27, no.1, p.7-35 (Feb. 1983).
A molecular network theory incorporating the concept of entanglement disruption and regeneration was previously developed (1981) to describe not only steady-state but also transient rheological properties of monodisperse polymer melts and concentrated solutions. The viscoelastic responses of these systems are dominated by a rapid segmental motion at short times and a more sluggish, structure-dependent network relaxation process at long times. In a binary blend of monodisperse fractions, the entangled network is composed of chains of two different lengths. The chain dynamics, and thus the characteristic response time, of each component in such a system is influenced by the presence of the coexistent component. This interaction is accommodated by a simple mixing assumption, which leads to accurate predictions of composition-dependent linear viscoelastic properties, such as zero-shear viscosity. In addition, the model gives an excellent description of the shear-rate-dependent viscosity curves of binary blends of various compositions and concentrations. (35 refs.)

66542 Shear fracture in cone-plate rheometry. R.I.Tanner, M.Keentok (Dept. of Mech. Engng., Univ. of Sydney, Sydney, NSW, Australia).
J. Rheol. (USA), vol.27, no.1, p.47-57 (Feb. 1983).
When subject to moderate shear rates in a cone-plate and parallel plate rheometer, viscoelastic samples tend to fracture at the edge of the sample thus preventing the measurement of viscosity and normal stresses at high shear rates. An explanation of this behavior has been given in terms of a critical elastic strain energy by Hutton and the authors offer an alternative explanation based on fracture mechanics. It is shown that fracture occurs if $|N_2| > \Gamma/3a$, where N_2 is the second normal stress difference, Γ is the surface tension coefficient, and a is the size of the fracture. The experimental data show that this equation correctly predicts the occurrence of shear fracture and also the shear rate at which it occurs. At high shear rates, Newtonian liquids and some viscoelastic liquids are ejected from the cone-plate and parallel plate rheometer due to the effect of centrifugal forces. (10 refs.)

66543 Effect of shear degradation on the rheological properties of dilute drag-reducing polymer solutions. Hsun-Fu David Chang, R.Darby (Dept. of Chem. Engng., Texas A&M Univ., College Station, TX, USA).
J. Rheol. (USA), vol.27, no.1, p.77-88 (Feb. 1983).
Apparent viscosity over a range of 10^6 s^{-1} in shear rate and first normal stress difference functions for dilute drag-reducing solutions of Separan AP-30 in distilled water were measured for both freshly prepared and shear-degraded solutions, for concentrations from 100 to 500 wppm. A nonlinear integral constitutive equation is proposed which accurately represents these data, and the effects of concentration and shear degradation on the properties (e.g., the model parameters) is shown. Shearing has a greater effect on the low shear viscosity of these solutions than it has on the elastic properties, resulting in a greater degree of drag reduction for the sheared than the fresh solutions. (21 refs.)

66544 Unusual rheology of a branched, water-soluble chitosan derivative. M.Yalpani (Dept., of Pathology, Univ. of British Columbia, Vancouver, British Columbia, Canada), L.D.Hall, M.A.Tung, D.Brooks.
Nature (GB), vol.302, no.5911, p.812-14 (28 April 1983).
Reports some unusual non-Newtonian features of 1-deoxylactit-1-yl chitosan, which displays low-shear Newtonian behaviour, a medium-shear viscosity increase (dilatancy), and a high-shear viscosity drop (pseudoplasticity). In conditions of steady shear the shear stress-time function varies in the different shear rate regimes. A 2% solution of this derivative exhibits unique oscillatory behaviour under steady shear at the transition point between the dilatant and pseudoplastic regimes. (15 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior ....See Entry 64582

New method to determine characteristic time of viscoelastic fluids ....See Entry 66566

Free convection flow of a second-order fluid along a porous vertical plate with periodic suction ....See Entry 66577

Effect of small-amplitude harmonic vibrations on viscoelastic flows in a plane slider bearing ....See Entry 66598

Non-Newtonian behavior of polymeric liquids ....See Entry 66599

Molecular dynamics simulations of the rheological properties of simple fluids ....See Entry 66600

Finite-amplitude periodic extensional flows ....See Entry 66602

Adiabatic shearing of incompressible fluids with temperature-dependent viscosity ....See Entry 66603

The dynamics of simple fluids in steady circular shear ....See Entry 66604

Couette viscometry of Casson fluids ....See Entry 66653

Second-grade fluid film lubrication in Hertzian contacts with reference to synovial joints ....See Entry 68977

46.90 OTHER TOPICS IN MECHANICS, ELASTICITY, AND RHEOLOGY

66545 Mathematical models of the methods for calculations of shape and tensile forces in moving thread systems. W.Hackmann (Wilhelm-Pieck-Univ. Rostock, Rostock, Germany).
Z. Angew. Math. & Mech. (Germany), vol.63, no.3, p.173-84 (1983). In German.
Evaluates shape and tensile forces in systems of threads uniformly moving in a viscous fluid. Two kinds of mathematical models are described. Model 1 uses a system of ordinary differential equations of the first order for shape and tensile force. Model 2 uses a system of integral equations for the tensile force. Further there are stated sufficient conditions to solve model 2 by means of successive approximations. After discretization of model 2 by the centered Euler scheme (or box scheme) one can use the method of successive approximation to the discretized system under similar sufficient conditions. Error bounds of type $O(h^2)$ are stated for the solutions of the discretized system belonging to model 2. At last results are deduced for the applicability of Newton's method to the discretized system. (9 refs.)

47.00 FLUID DYNAMICS

(for fluid dynamics of quantum fluids, see 67.; for geophysical fluid dynamics, see 92.10; for astrophysical gas dynamics, see 95.30; for biological fluid dynamics, see 87.45)

47.10 GENERAL THEORY

(see also 03.40G Mathematical aspects)

66546 Finite elements and characteristics applied to advection-diffusion equations. Y.Hasbani, E.Livne, M.Bercovier (Inst. of Math., Hebrew Univ. of Jerusalem, Jerusalem, Israel).
Comput. & Fluids (GB), vol.11, no.2, p.71-83 (1983).
Deals with an algorithm for the solution of advection-diffusion equations based on the finite element method combined with the discretization of the total differential $D\rho/Dt$. The authors give in the one dimensional case the finite difference analog of the Galerkin method. Diffusion of the scheme is studied in the two dimensional case by means of a classic example. They show that the scheme is stable, has no phase error and leads to simple problems at each time step. The authors extend the study to a simple 2D transport problem in rotating flow. (12 refs.)

66547 Progress in computational physics. E.Turkel (School of Math., Tel-Aviv Univ., Tel-Aviv, Israel).
Comput. & Fluids (GB), vol.11, no.2, p.121-44 (1983).
Recent progress in computational methods for time dependent fluid dynamics is presented. The emphasis is on advances applicable to large scale systems with the connection between the numerics and the physics of the code stressed. All aspects of a working code are discussed including such topics as initialization, boundary conditions, grid generation in addition to algorithmic advances. One sometimes uses a time dependent method as an iteration procedure to reach a steady state solution. Work in accelerating the convergence to the steady state is also surveyed. (307 refs.)

66548 Solutions of the Navier-Stokes equations by group methods. R.E.Boisvert (School of Math., Georgia Inst. of Technol., Atlanta, GA, USA), W.F.Ames, U.N.Srivastava.
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.31-5 vol.3
Using the machinery of Lie theory (groups and algebras) applied to the Navier-Stokes equations a number of exact solutions for the steady state are derived in (two) three dimensionals. It is then shown how each of these generates an infinite number of time dependent solutions via (three) four arbitrary functions of time. This algebraic structure also provides the mechanism to search from other solutions since its character is inferred from the basic equations. (9 refs.)

Homogeneous property and flux splitting in gas dynamics ......See Entry 64690

A multigrid scheme for the thermal-hydraulics of a blocked channel ....See Entry 65539

Steady viscous flows by compact differences in boundary-fitted coordinates ....See Entry 66551

Numerical studies on a confined channel flow ....See Entry 66632

47.15 LAMINAR FLOWS

66549 Stream function formulation of the 2-D Stokes problem in a multiply-connected domain. F.Crowet, C.Dierieck (Philips Res. Lab., Bruxelles, Belgium).
J. Mec. Theor. & Appl. (France), vol.2, no.1, p.67-74 (1983).
Deals with the problem of characterizing the stream function associated with a velocity field, described by a 2-*D* Stokes problem (i.e. viscous incompressible plane flow). As is well known, such a problem amounts to solving a biharmonic equation. Attention is focused on the determination of the exact boundary conditions, especially in a multiply-connected domain. In particular for the stream function formulation of a 2-*D* Stokes problem with homogeneous boundary conditions, it is possible to calculate explicitly the

constants which the stream function should attain on each connected component of the boundary. (7 refs.)

66550 Mass transfer between a suspension of fibres and a rotating disk. D.Huin, G.Cognet (Lab. d'Energetique et de Mecanique Theorique et Appliquee, Nancy, France).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.1-12 (Jan.-Feb. 1983). In French.
Considers the laminar flow of a suspension of fibres generated by a rotating disk. Addition of fibres increases noticeably the mass transfer at the disk surface meanwhile the skin friction seems not to be really modified by their presence. (5 refs.)

66551 Steady viscous flows by compact differences in boundary-fitted coordinates. X.Aubert, M.Deville (Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
J. Comput. Phys. (USA), vol.49, no.3, p.490-522 (March 1983).
Fourth-order compact differencing is applied to the steady solution of two-dimensional viscous incompressible flows at moderate Reynolds number. The physical region where the fluid flow occurs is mapped onto a rectangle by means of the boundary-fitted coordinates transformation method. The design of the general numerical algorithm rests upon discretization of velocity components and pressure field at the same grid points. The validity of this procedure is assessed by the investigation of a Stokes test problem. Fourth-order numerical results are compared the analytical solution, second-order results and Chebyshev tau approximation. (28 refs.)

Heat transfer enhancement in oscillatory cavity flow ....See Entry 66563

Frictional resistance in fiber suspensions. II. Flow on a rotating disk ....See Entry 66614

Computer simulation of laminar dilute suspension flows in asymmetric pressure-driven membrane units ....See Entry 66624

Numerical studies on a confined channel flow ....See Entry 66632

Measurement of the velocity of axisymmetric laminar flow by an optical visualisation technique with coherent light ....See Entry 66658

Effect of the diffusion boundary layers on the surface charge density in passive membranes ....See Entry 68800

47.15C Laminar boundary layers

66552 Laminar compressible flow between close rotating disks. An asymptotic and numerical study. M.Israeli (Computer Sci. Dept., Technion-Israel Inst. of Technol., Haifa, Israel), M.Ungarish.
Comput. & Fluids (GB), vol.11, no.2, p.145-57 (1983).
Laminar steady compressible flow between close rotating thermally conducting axisymmetric disks with inflow was investigated by means of a numerical solution of the Navier-Stokes equation and an asymptotic analysis. The approximate solution, obtained for small ϵ, E and H (Rossby and Ekman numbers, and height/radius, respectively) is valid for 'merged', 'close' and 'separate' boundary layers on the disks, corresponding to $\beta \ll k1$, $\beta \simeq 1$ and $\beta \gg 1$, respectively (where $\beta = H/2\sqrt{E}/\rho$, and ρ is the non-dimensional density). These three cases may appear simultaneously in different regions of the same system due to the large variation of ρ in the radial direction. The small ϵ (i.e. negligible convection terms) does not necessarily imply small perturbations of the pressure, and a special treatment of the pressure term was used in order to account for this feature, which sometimes culminates in inversion of the radial pressure gradient. The numerical solution was obtained by a finite-difference, modified Cheng-Allen method, using a non-uniform mesh. The numerical and the approximate solution are in good agreement. (14 refs.)

Forced convection heat transfer from an elliptic cylinder of axis ratio 1:2 ....See Entry 66562

Exact solution of the thermal boundary-layer equations for an arbitrary heat-flux distribution on a surface in a flow ....See Entry 66567

Laminar flow of a non-Newtonian fluid in the thermal entrance region of a smooth pipe ....See Entry 66572

Numerical solution of the two-dimensional equations of laminar flame propagating down a cylindrical tube ....See Entry 66647

47.15F Stability of laminar flows

Evaluation of MHD-processes in saline coolants ....See Entry 66644

47.20 HYDRODYNAMIC STABILITY

Phenomenon of wave-length increase in Rayleigh-Benard convection and criterion of maximum entropy production ....See Entry 66560

Heat transfer enhancement in oscillatory cavity flow ....See Entry 66563

Loss of stability condition for free convection in a porous layer ....See Entry 66573

Small-amplitude finite-rate waves in suspensions of particles in fluids ....See Entry 66588

Compressible Rayleigh-Taylor instability ....See Entry 66590

Secondary instability of plane channel flow to subharmonic three-dimensional disturbances ....See Entry 66631

An application of adjoint variational method to the capillary instability in liquid ....See Entry 66633

Rayleigh-Taylor instability of a fluid supported against gravity by an oscillating magnetic field ....See Entry 66636

Nonlinear self-excited oscillations in MHD flows ....See Entry 66638

Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. I. Experiments ....See Entry 69226

Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. II. Theory: onset of convection ....See Entry 69227

Kelvin-Helmholtz instability and the Jovian Great Red Spot ....See Entry 69540

47.25 TURBULENT FLOWS, CONVECTION, AND HEAT TRANSFER

66553 Numerical simulation of turbulence on a multiprocessor system. P.Leca, P.Roy.
Bull. Dir. Etud. & Rech. Ser. C (France), no.1, p.95-102 (1983). In French, English. (1^{er} Colloque International sur les Methodes Vectorielles et Paralleles en Calcul Scientifique (1st International Colloquium on Vectorial and Parallel Methods in Scientific Calculations), Paris, France, 17-18 March 1983).
Array-processors attached to a minicomputer may be an alternative to conventional computers. Such a system can be built to take into account a MIMD parallelism. A turbulence numerical simulation code has been implemented on an installation of this kind. Problems relative to structure and flow of data, I/O bandwidth, feeding of the processors and parallelism expression are especially pointed out. (17 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior ....See Entry 64582

A simplified finite element model for fully developed axial turbulent flow in rod bundles ....See Entry 65535

Formulation of a two-fluid model for mixing in LWR bundles ....See Entry 65536

Separation of time-averaged turbulence components by laser-induced fluorescence ....See Entry 65920

Eddy viscosity in axially symmetric, swirling jets ....See Entry 66608

Frictional resistance in fiber suspensions. I. Pipe flow ....See Entry 66613

Frictional resistance in fiber suspensions. II. Flow on a rotating disk ....See Entry 66614

A two-equation turbulence model for two-phase flows ....See Entry 66622

Numerical studies on a confined channel flow ....See Entry 66632

Turbulence with a spectral gap ....See Entry 69302

47.25C Isotropic turbulence

Turbulent heat transfer on the surface of a steam-chugging bubble ....See Entry 66616

Flow of an electrically conducting liquid in a pipe with a longitudinal magnetic field ....See Entry 66639

47.25F Boundary layer and shear turbulence

66554 Analysis of a turbulent boundary layer subjected to a strong adverse pressure gradient. N.Afzal (Dept. of Mech. Engng., Aligarh Muslim Univ., Aligarh, India).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.563-76 (1983).
Two non-dimensional parameters $\Lambda = \tau_\omega / p_x \delta$ and $R_p = U_p \delta / \nu$ are defined where τ_ω is the wall stress, $p_\omega (>0)$ is the pressure gradient to which the turbulent boundary layer (of thickness δ) is subjected, ν is the kinematic viscosity, $U_p = (\nu p_x / p)^{1/3}$ is a characteristic velocity and p is the density. The limit corresponding to the strong adverse pressure gradient is formulated as $\Lambda \rightarrow 0$, $R_p \rightarrow \infty$, ΛR_p finite. Using appropriate inner and outer asymptotic expansions, both above a wall layer possibly scaling with τ_ω and ν, it is found by an application of Millikan's argument that there is an inertial sublayer where the streamwise velocity distribution obeys a half-power law, whose slope depends on Λ, and intercept on ΛR_p. Indeed comparison with available experimental data shows the inner law to be well represented by $\mu / U_p = (3.5 + 19\Lambda)(y U_p / \nu)^{1/2} + 2.5 \Lambda R_p$. The outer flow obeys a generalized defect law; use of constant eddy viscosity closure yields results in good agreement with experiment. (21 refs.)

66555 A few applications of the Nee-Kovasznay model for shear flow turbulence. R.Takaki (Faculty of General Education, Tokyo Univ. of Agriculture & Technol., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1186-93 (April 1983).
The Nee-Kovasznay model is applied to the three turbulent shear flows; the wall region of the turbulent boundary layer, the plane mixing layer and the turbulent Rayleigh problem. The model equation is solved analytically, partly by the use of a technique analogous to the integral method for turbulence prediction. The former two applications are intended to determine the two unknown parameters in the model by comparing the theory with experiment, the results of which are $A = 0.20$ and $B = 2.2$. In the third problem approximate solutions for the mean velocity and the turbulent viscosity are obtained and compared with experiments. Agreements are satisfactory. The theory shows also some disagreements, which may be due to the lack of the concept of 'coherent structure' in the model. (15 refs.)

66556 A statistical theory of thermally-driven turbulent shear flows, with the derivation of a subgrid model. A.Yoshizawa (Inst. of Industrial Sci., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1194-205 (April 1983).
A statistical theory is presented for the turbulent motion of an incompressible fluid subject to the Boussinesq convection. The Reynolds stress and the heat flux for arbitrary mean velocity and temperature distributions are calculated with the aid of the two-scale Direct-Interaction formalism, i.e. the DI formalism incorporated with the separation of scales of the mean and fluctuating fields. The two quantities are expressed in terms of binary correlations and responses of the fluctuating field, and these expressions are simplified by the use of the inertial-range theory. As an application of the results, a subgrid model is derived for the large-eddy simulation of turbulent shear flows with buoyancy effects. (18 refs.)

66557 Large-amplitude long waves in a shear flow. M.E.Stern, N.Paldor (Graduate School of Oceanography, Univ. of Rhode Island, Kingston, RI, USA).
Phys. Fluids (USA), vol.26, no.4, p.906-19 (April 1983).
Large amplitude disturbances in a boundary layer shear flow are considered in an inviscid and long-wave theory. Initially weak horizontal convergences are concentrated and amplified in time, thereby increasing the maximum normal velocity (ν) until it becmes comparable with the horizontal velocity. The effect is first demonstrated in a two-dimensional model having piecewise uniform vorticity. The leading edge of the compact disturbance propagates downstream more rapidly than the trailing edge, but no 'quiet' zone appears in the center. Instead $\nu \rightarrow \infty$ and a tendency for wavebreaking occurs. The evolving large ν pattern is consistent with observations of the laminar spike just prior to its breakdown. The long-wave theory is generalized to three-dimensional motions, and the effect of an initial spanwise divergence is such as to rationalize the initial vorticity assumed in the two-dimensional model. (9 refs.)

Effect of initial conditions on constant pressure mixing between two turbulent streams .... See Entry 66589

Numerical simulation of a compressible turbulent boundary layer over a conductive wall with line heat source .... See Entry 66594

Experimental determination of the random lump-age distribution in the boundary layer of the turbulent pipe flow using laser-Doppler anemometry .... See Entry 66630

47.25J Turbulent diffusion

66558 Turbulent diffusion of mass in circular pipe flow. A.N.Puri, C.Y.Kuo, R.S.Chapman (Dept. of Civil Engng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Appl. Math. Modelling (GB), vol.7, no.2, p.135-8 (April 1983).
An implicit finite difference scheme was used to solve the convective-diffusion equation to predict the steady-state transport of a conservative, neutrally buoyant tracer injected along the centreline into a fully developed turbulent pipe flow. Three different distributions for the radial mass diffusivity have been compared with two independent sets of experimental data. The results indicate that the distribution based on the turbulent kinematic eddy viscosity predicted by a k-l model produces the closest agreement between the numerical model predictions and the experimentally observed tracer distribution. (14 refs.)

66559 Thermal diffusivity in mesophases: a systematic study in 4-4′-di-(*n*-alkoxy) azoxy benzenes. W.Urbach, H.Hervet, F.Rondelez (Phys. de la Matiere Condense, Coll. de France, Paris, France).
J. Chem. Phys. (USA), vol.78, no.8, p.5113-24 (15 April 1983).
The authors present a systematic study of thermal diffusivity in the nematic liquid crystalline phase of 4-4′-di-(*n*-alkoxy) azoxy benzenes and several other materials. The data allows separation of the respective contributions of the rigid central core and of the flexible aliphatic chains. For the components of the diffusivity tensor parallel to the long molecular axis, it is found that they differ by as much as a factor of 6 in favour of the core contribution. Combining the present observations with their earlier results, they are now able to draw general conclusions on the thermal diffusivity in a nematic and smectic A, B, and C phases. They have also developed two semiquantitative models based, one on a static network of distributed resistances, and the other on an extension of the Eyring kinetic model for the thermal conductivity of simple liquids. Only the dynamic model yields a satisfactory description of the authors' data. The distance over which the thermal energy is not transferred instantaneously upon collision between two neighbouring molecules is found to correspond to the aliphatic chain length (calculated for a freely rotating chain). Using this formalism, a priori calculations of the thermal diffusivities can be performed, to better than 20%, for any rodlike liquid crystalline material. (24 refs.)

Experimental study of an axial discharge in a turbulent gas flow .... See Entry 66770

Instantaneous Ramanography of a turbulent diffusion flame ... See Entry 68779

47.25M Noise (turbulence generated)

Experimental determination of the random lump-age distribution in the boundary layer of the turbulent pipe flow using laser-Doppler anemometry .... See Entry 66630

47.25Q Convection and heat transfer

(see also 44.25 Convective and constrained heat transfer)

66560 Phenomenon of wave-length increase in Rayleigh-Benard convection and criterion of maximum entropy production. Chen Shi-Gang (Inst. of Phys., Acad. Sinica, Peking, China), Wang You-Qin.
Acta Phys. Sin. (China), vol.32, no.2, p.209-15 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The phenomenon of wave-length increase occurred in Rayleigh-Benard convection is analysed by numerical method, and the result obtained is in good agreement with experiment. The calculations for stability and entropy production show that the criterion of maximum entropy production for relative stability of steady states is correct. (11 refs.)

66561 Effects of variable physical properties on free convection in a porous insulating layer. T.Masuoka (Dept. of Mech. Engng., Kyushu Inst. of Technol., Kitakyushu, Japan), H.Shimomura, Y.Okamoto.
Bull. JSME (Japan), vol.26, no.212, p.247-53 (Feb. 1983).
A numerical study is made of the effects of variable properties on free convection in vertical, helium- (or air-) saturated porous layer. The temperature differences between hot and cold boundary walls are as large as 1000°C. The effects of variations in viscosity, thermal conductivity and density are included. Flow patterns are found to be considerably distorted in a horizontal direction to the symmetrical patterns predicted by the constant-property theory, whereas the overall heat-transfer characteristics do not alter very much provided that representative properties are evaluated at a mean temperature. At sufficiently large amplitude of convection, however, the deviation from the Boussinesq approximation is not negligible. (11 refs.)

66562 Forced convection heat transfer from an elliptic cylinder of axis ratio 1:2. T.Ota (Dept. of Mech. & Prod. Engng., Akita Univ., Akita, Japan), S.Aiba, T.Tsuruta, M.Kaga.
Bull. JSME (Japan), vol.26, no.212, p.262-7 (Feb. 1983).
An experimental investigation has been made to clarify the heat transfer characteristics of an elliptic cylinder of axis ratio 1:2. The testing fluid was air and the Reynolds number ranged from about 5000 to 90000. The angle of attack α was varied from 0° to 90°. The local heat transfer behavior is clarified and it is quite different from that of a circular cylinder. In the region of $\alpha>40°$, the heat transfer rate from the upstream surface, on which a laminar boundary layer develops, becomes lower than that from the downstream surface in the separated flow region. The mean heat transfer coefficient Nu_m depends upon the angle of attack along with the Reynolds number. It is found that Nu_m is the highest for $\alpha=75°$ to 90° and is the lowest for $\alpha=30°$ over the whole Reynolds number range studied. The mean heat transfer rate from the elliptic cylinder investigated in the present work is higher than that from the circular cylinder at all the angles of attack over the Reynolds number range studied. (20 refs.)

66563 Heat transfer enhancement in oscillatory cavity flow. G.Antonini, E.Brunier, G.Guiffant (Dept. de Genie Chimique, Univ. de Technol. de Compiegne, Compiegne, France).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.13-23 (Jan.-Feb. 1983).
The unsteady fluid motion driven in a square cavity by the combined effects of a vibrating wall and natural convection is examined. The mean heat transfer characteristics of the oscillatory cavity flow are derived and discussed. (12 refs.)

66564 Water absorption by a solution of lithium bromide in wetted wall columns with tangential feed. S.Gabsi, R.Bugarel (Inst. du Genie Chimique Chemin de la Loge, Toulouse, France).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.49-58 (Jan.-Feb. 1983).
One of the most effective methods of increasing the rate of heat transfer is to carry it in the form of thin film. The purpose of the reported research is to investigate water absorption by a solution of lithium bromide under vacuum in wetted wall columns with tangential feed in order to apply it in a cycle of absorption heat pump. It is shown that film-wall heat transfer coefficient increases with pressure, vapor and liquid flow rate but it does not vary with the solution concentration in the range of the experiments. (22 refs.)

66565 Heat transfer by natural convection in a vertical porous layer. N.Rudraiah, T.Masuoka, M.S.Malashetty (Dept. of Maths., Central Coll., Bangalore Univ., Bangalore, India).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.59-76 (Jan.-Feb. 1983).
Heat transfer by a natural convection in a vertical porous layer heated from below and cooled from above is studied analytically. In the case of linear theory, the normal mode technique is used to find the criteria for the onset of convection and it is shown that convection sets in when the critical Rayleigh number exceeds π^2. The nonlinear theory is investigated using normal mode technique combined with the orthonormal sequences which determines the amplitudes and hence the heat transfer. It is shown that uni-cellular pattern exist and the corresponding heat transfer increases with Rayleigh number. (12 refs.)

66566 New method to determine characteristic time of viscoelastic fluids. E.Y.Kwack, J.P.Hartnett (Energy Resources Center, Univ. of Illinois, Chicago, IL, USA).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.77-82 (Jan.-Feb. 1983).
An extra dimensionless parameter involving the ratio of the elastic and viscous forces, the Weissenberg number, is necessary to correlate the friction and heat transfer behaviour of viscoelastic fluids. The evaluation of the Weissenberg number requires a measurement of the first normal force difference or, alternatively, the determination of the characteristic time of the fluid. The authors suggest that the characteristic time of viscoelastic fluids can be determined by a simple pressure drop measurement. The basis for the proposed method is presented. More detailed measurements are required to validate the procedure. (17 refs.)

66567 Exact solution of the thermal boundary-layer equations for an arbitrary heat-flux distribution on a surface in a flow. A.Sh.Dorfman (Inst. of Tech. Heat Phys., Acad. of Sci., Ukrainian SSR).
High Temp. (USA), vol.20, no.4, p.567-74 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.683-91 (July-Aug. 1982). [received: April 1983]
An exact solution of the equations for a thermal laminar boundary layer is obtained for an arbitrary distribution of the heat flux on the surface and a power-law velocity distribution in the outer flow. The solution is constructed in the form of a series in the shape parameters and in an integral form containing the influence function of the unheated section. The influence functions are calculated for gradient flows and arbitrary values of the Prandtl number. The results can be applied to heat-transfer calculations for any Neumann-type boundary condition. (11 refs.)

66568 Investigation of flow distribution in cells with triangular tubular bundles. P.I.Bystrov, A.A.Volovik, V.S.Mihkailov (Inst. of Railroad Transport Engrs., Dnepropetrovsk, USSR).
High Temp. (USA), vol.20, no.4, p.582-6 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.700-4 (July-Aug. 1982). [received: April 1983]
The results of experimental investigations of the flow distribution in cells with triangular tubular bundles with the relative spacing varying in the range $s/d=1.028$-1.5 are presented. Approximate dependences are proposed for calculating the hydraulic nonuniformity in the intertubular space of heat exchangers based on the use of the equation of motion of variable-mass flow in a quasi-one-dimensional formulation. (5 refs.)

66569 Calculation of heat transfer in smooth pipes with turbulent flow of gaseous heat-carriers with constant and variable physical properties. V.A.Kurganov (Inst. of High Temperatures, Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.587-93 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.705-11 (July-Aug. 1982). [received: April 1983]
Universal working equations are proposed for heat transfer to gases and vapors in hydraulically smooth heated pipes with turbulent flow and boundary conditions of the first and second kind. (22 refs.)

66570 A numerical simulation of 'convection' in a cylindrical geometry. P.Manneville (CENS, Gif-sur-Yvette, France).
J. Phys. (France), vol.44, no.5, p.563-71 (May 1983).
Rudimentary numerical simulations performed on a two-dimensional model of three-dimensional convection already give valuable information about the process of non-linear pattern selection in convection experiments. The author has considered a disc which corresponds to a cylindrical box with intermediate aspect ratio ($R/h\sim6$). Starting with low level random initial conditions they observe: 1) the linear growth of unstable modes, 2) a saturation stage during which the selection is very active, 3) a final reorganization corresponding to the slow motion of defects. Solutions which have been observed were stationary even with non-linear terms which did not derive from a potential. The structures found in these simulations are strikingly similar to those obtained experimentally with comparable aspect ratios and high Prandtl numbers. Limitations and possible improvement of the model are also discussed. (32 refs.)

66571 Nonlinear evolution of the disturbance in a natural convection induced in a vertical fluid layer. J.Mizushima (Dept. of Information Sci., Sagami Inst. of Technol., Fujisawa, Japan), K.Gotoh.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1206-14 (April 1983).
The nonlinear evolution of the disturbance in a natural convection induced in a fluid layer between two parallel vertical walls kept at different temperatures is investigated on the basis of the weakly nonlinear theory. The theory is used in an improved form for the evaluation of the coefficients in the evolution

equation of disturbance. The amplitude of disturbance and the heat transfer across the fluid layer are determined in a super-critical and equilibrium condition. The curve of the mean Nusselt number N versus the Grashof number G has a small hump at the critical Grashof number G_c, and that the estimation of N so far established is reasonable only in a narrow range of G close to G_c.

66572 Laminar flow of a non-Newtonian fluid in the thermal entrance region of a smooth pipe. K.Rup (Politech. Krakowska, Krakow, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.337-47 (1981). In Polish.
To investigate the influence of the temperature boundary condition of the third kind on the laminar heat transfer of a pipe, the energy equation is solved by applying the momentum integral method. The power-law model characterises the non-Newtonian behavior. Uniform and fully developed velocity profiles are considered. Constant fluid properties are assumed. The effect of heat generation by viscous dissipation is included. It is concluded that there can be a significant influence of Biot number, Brinkman number and flow index non mean temperature and local Nusselt number. The results are compared with the available solutions of Newtonian fluid: an excellent agreement has been found. (8 refs.)

66573 Loss of stability condition for free convection in a porous layer. B.Borkowski, W.Kordylewski (Politech. Wroclawska, Wroclaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.463-75 (1981). In Polish.
A stability analysis of two-dimensional natural convection in a porous layer has been performed. By means of Galerkin's method the system of two partial differential equations has been replaced by a system of six ordinary differential equations,. The branch of steady-state solutions referring to the primary stage of free convection has been determined. The condition for stability loss of fluid motion in a porous layer induced by a temperature gradient is determined by the Hopf bifurcation point for a Rayleigh number equal to $30\pi^2$. (13 refs.)

66574 Heat transfer in a bounded vortex MHD-flow with volume heat release. O.A.Glazov.
Magnetohydrodynamics (USA), vol.18, no.3, p.254-8 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.52-6 (July-Sept. 1982). [received: April 1983]
Heat transfer in a vortex flow bounded by a cylindrical surface of radius r_o is discussed. The z axis of the cylindrical coordinate system (r, ϕ, z) is assumed to be directed along the axis of the cylinder bounding the flow. Boundary conditions of the first kind, which are dependent in a periodic way on the azimuthal coordinate, are adopted on the cylindrical surface: $T(r_0,\phi)=T_0+T_a\sin\phi$, where T_o and T_a are assumed to be constant positive quantities. The heat transfer by a vortex flow under the above boundary conditions is investigated in the presence of a steady heat release $q_e(r,\phi)$ in the fluid volume. (1 ref.)

66575 Natural convection with transpiration over a vertical porous plate at high temperature. Effects of a nonuniform blowing. D.Lemonnier, Doan-Kim-Son (Lab. de Thermique, ENSMA, Poitiers, France).
Mech. Res. Commun. (GB), vol.9, no.6, p.359-65 (Nov.-Dec. 1982). [received: March 1983]
A numerical study suitable for large ambient-wall temperature differences is developed and consideration is given to the influence of non uniform blowing on the velocity and temperature profiles and heat transfer. It was found that the natural convection flow with blowing and suction is not only dependent on the quantity of fluid that is being transpired but also on the distribution of this transpiration. Particularly, the heat transfer between the plate and the fluid was found to be very sensitive to both transpiration rate and blowing distribution. (5 refs.)

66576 Effect of rotation on the stability of a bounded cylindrical layer of fluid heated from below. J.C.Buell, I.Catton (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA).
Phys. Fluids (USA), vol.26, no.4, p.892-6 (April 1983).
The onset of steady natural convection in a rotating cylindrical volume of fluid completely bounded by rigid surfaces is examined for moderate Taylor numbers ($Ta \leq 2\times10^6$) and aspect ratios ($A\leq2$). The critical Rayleigh number for three dimensional disturbances is found to be lower than that for the radially unbounded problem by up to a factor of six. The thermal boundary condition on the lateral walls is shown to have a greater effect here than in the nonrotating case. (12 refs.)

66577 Free convection flow of a second-order fluid along a porous vertical plate with periodic suction. R.C.Chaudhary, P.R.Sharma (Dept. of Math., Univ. of Rajasthan, Jaipur, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.6/3-22 (Nov. 1982). [received: April 1983]
The authors study three-dimensional flow and heat transfer for a non-Newtonian fluid, i.e. free convection flow of a second-order fluid along a porous vertical plate with transverse sinusoidal suction velocity distribution. The effect of the non-Newtonian fluid parameter on the stress component and heat flux has been discussed numerically. (4 refs.)

66578 Heat induced flow effects on heat transfer properties of a pulsed superconductor. R.S.Kensley, Y.Takahashi, K.Okuno, M.Nishi, H.Tsuji, L.Dresner, T.Ando, S.Shimamoto.
Report JAERI-M-82-107, Japan Atomic Energy Res. Inst., Tokai, Ibaraki (Aug. 1982), 18 pp.
Heat transfer properties of a pulsed conductor, called JA-10, were measured and important effects caused by heat induced flow were found. JAERI has developed the conductor JA-10 for research and development of superconducting poloidal coils for Tokamak reactors. JA-10 is a 10 kA, 7-T pulsed conductor with NbTi bundles around a stainless steel flat core. Heat transfer properties from the surface of this conductor is an important basis for its stability during pulsed operation, therefore the authors measured the heat transfer property under the same conditions as a wound coil. By this experiment, it was clarified that turbulent flow in the uninterrupted vertical cooling channels strongly enhance heat transfer properties of a pulsed conductor like JA-10. (4 refs.)

66579 Forced flow cooling studies of volumetrically heated porous layers. V.X.Tung, V.K.Dhir, D.Squarer (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.876-83 vol.2
Experiments were conducted in a 9.5 cm ID pyrex jar with a filter plate to support the particulate layer. The jar had a provision for flow of subcooled liquid at the bottom. In the experiments the size of the spherical particles was varied from 3175 to 4763 μM while the bed porosity was kept fixed at about 0.4. The porous layer height was varied from 10 cm to 20 cm. The particles were heated inductively. Freon-113 was used as the coolant. The flowrate of the coolant and the volumetric heat generation rate in the particles were varied so that either superheated or wet vapor could exit the porous layer. The porous layer temperature was measured at different locations with 30-gage copper-contantan thermocouples. The pressure drops between different segments of the porous layer were measured with manometers. (6 refs.)

Solution of a one-dimensional phase change problem with non-uniform initial temperature .... See Entry 64865

Advanced safety code CATHARE summary of verification studies on 'separate effect' experiments .... See Entry 65324

Flow regime and heat transfer measurements during reflooding with steady and oscillatory coolant injection .... See Entry 65518

Dryout and post-dryout heat transfer in helically coiled tubes .... See Entry 65519

Effect of system pressure on film boiling heat transfer, minimum heat flux and minimum temperature .... See Entry 65520

A study of subcooled film boiling heat transfer under reactivity initiated accident conditions in light water reactors .... See Entry 65521

The quenching of thick-walled nickel test sections .... See Entry 65522

Comparison of flashing heat transfer correlations .... See Entry 65523

An appraisal of interfacial vapour generation laws used in thermal-hydraulic analysis .... See Entry 65524

Evaluation of nonequilibrium effects in bundle dispersed flow film boiling .... See Entry 65525

Inferring nonequilibrium vapor conditions in convective film boiling .... See Entry 65526

Post dry-out heat transfer in uncovered core accidents .... See Entry 65527

A thermodynamic similarity correlation for modeling of flow boiling dryout .... See Entry 65528

Evaluation of performance of eight CHF correlations with the VIPRE-1 computer code .... See Entry 65529

Application of multi-fluid model in dryout prediction .... See Entry 65530

A critical heat flux correlation for triangular array rod bundles with tight lattices .... See Entry 65531

Evaluation of predictability of multiple CHF events .... See Entry 65532

Investigation of transient critical heat flux phenomena and forced convection film boiling heat transfer .... See Entry 65533

Annular burnout data from rod bundle experiments .... See Entry 65534

Finite elements and characteristics applied to advection-diffusion equations .... See Entry 66546

A statistical theory of thermally-driven turbulent shear flows, with the derivation of a subgrid model .... See Entry 66556

Atomistic nonequilibrium computer simulations .... See Entry 66583

Numerical simulation of a compressible turbulent boundary layer over a conductive wall with line heat source .... See Entry 66594

Adiabatic shearing of incompressible fluids with temperature-dependent viscosity .... See Entry 66603

An experimental investigation into the effect of changes in the geometry of a slot nozzle on the heat transfer characteristics of an impinging air jet .... See Entry 66606

Efficiency of combined jet cooling of a plate in conditions of complex heat transfer .... See Entry 66607

Turbulent heat transfer on the surface of a steam-chugging bubble .... See Entry 66616

MHD free-convection flow in the Stokes problem for a porous vertical plate by finite difference method .... See Entry 66634

Experimental studies of electroconvective motion in transformer oil .... See Entry 66640

Evaluation of MHD-processes in saline coolants .... See Entry 66644

Experimental study of the heat fluxes in a MHD channel .... See Entry 68895

Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. I. Experiments .... See Entry 69226

Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. II. Theory: onset of convection .... See Entry 69227

A self-similar flow of self-gravitating gas behind a shock wave with radiation heat flux. I .... See Entry 69485

A self-similar flow in generalised Roche model with radiation heat flux. II .... See Entry 69486

47.25R Wakes

66580 An experimental investigation of the wake of an axisymmetric body with a slanted base. X.J.Xia, P.W.Bearman (Dept. of Aeronautics, Imperial Coll., London, England).
Aeronaut. Q. (GB), vol.34, pt.1, p.24-45 (Feb. 1983).
The effect of base slant on the base pressure distribution, drag coefficient and vortex shedding characteristics of a model consisting of an axisymmetric main body with an ellipsoidal noise have been investigated for three fineness ratios; 3, 6 and 9. A sudden change in the drag coefficient and separated flow pattern is observed at a critical slant angle (for constant incident) or at a critical angle of incidence (for a constant base slant angle). The tests confirm that the value of the maximum drag coefficient is extremely sensitive to angle of incident. Measurements of the frequency of vortex shedding are presented and the structure of the wake is investigated using smoke visualization and hot-wire correlation measurements. The wake is found to be far less stable than that from a two-dimensional bluff body and the vortex structures are sometimes in-phase and sometimes out of phase across the wake. The effect of free-stream turbulence on this family of body shapes is observed to be different to that on three-dimensional blunt-faced bluff bodies. Free-stream turbulence is found to have a minimal effect on base pressure for slant angles giving a recirculating type near wake flow. When longitudinal vortices are present the addition of free-stream turbulence slightly reduces the magnitude of the peak suctions recorded on the base but has little effect on base drag. (17 refs.)

47.30 ROTATIONAL FLOW AND VORTICITY

66581 On the calculation of the velocity induced b a vortex-source cone. K.Varsamov, K.Yosifov, A.Haimov.
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.455-61 (1981). In English.
Describes the transition from numerical quadrature to linearized expressions for calculation of the velocity induced by unit vortex cones at points near the

vortex sheet. A criterion is obtained by comparing the results with the exact solution for singularity distribution of constant strength. (3 refs.)

66582 Interaction of a turbulent conducting vortex with a magnetic field. L.P.Gorbachev, A.Yu.Matronchuk.
Magnetohydrodynamics (USA), vol.18, no.3, p.249-53 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.47-51 (July-Sept. 1982). [received: April 1983]
The motion of a turbulent vortex ring in an infinite incompressible fluid has been discussed in previous work. Such motion is described with the help of the turbulent viscosity, and the self-similar problem for the case in which the viscosity depends on time has been investigated. Turbulent motion of a cylindrical vortex is investigated within the framework of the model of an incompressible fluid; the pressure is assumed to be constant over the entire volume of the vortex. A nonlinear equation in a cylindrical coordinate system is used to describe the turbulent vortex. (5 refs.)

66583 Atomistic nonequilibrium computer simulations. W.G.Hoover (Dept. of Appl. Sci., Univ. of California, Davis, CA, USA).
Physica A (Netherlands), vol.118A, no.1-3, p.111-22 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
Newton's, Lagrange's and Hamilton's equations of motion have been modified to include the effects of constraints, nonequilibrium fluxes, and gradients. These nonclassical equations provide estimates of the linear transport coefficients and, through nonlinear dissipative terms can also simulate nonequilibrium steady states. To illustrate the modified equations of motion, the author applies them to a simple three-oscillator problem. The new methods have also been used to study nonlinear problems with large coupled gradients. He describes two examples: the coupling of heat flow with rotation and the simulation of strong shockwaves in dense fluids. (23 refs.)

66584 *N*-solitons on a vortex filament. D.Levi (Inst. of Theoretical Phys., Warsaw Univ., Warsaw, Poland), A.Sym, S.Wojciechowski.
Phys. Lett. A (Netherlands), vol.94A, no.9, p.408-11 (4 April 1983).
The authors describe a purely algebraic algorithm for finding, in the localized induction approach, three-dimensional vortex motion corresponding to the N-soliton solution of the nonlinear Schrodinger equation. The method used relies essentially upon the geometric approach to soliton systems and consists in the construction of the corresponding soliton surfaces. For $N=0$ and $N=1$ they recover the straight line and Hasimoto vortex respectively, while for $N=2$ the algorithm gives a new vortex motion, of higher complexity, which is, presumably, an analytic expression for some scattering phenomena along vortices recently discovered by Browand and Hopfinger (1982). (17 refs.)

On the scattering of sound by a vortex ring .... See Entry 66416

Finite elements and characteristics applied to advection-diffusion equations .... See Entry 66546

Mass transfer between a suspension of fibres and a rotating disk .... See Entry 66550

Laminar compressible flow between close rotating disks. An asymptotic and numerical study .... See Entry 66552

Heat transfer in a bounded vortex MHD-flow with volume heat release .... See Entry 66574

Effect of rotation on the stability of a bounded cylindrical layer of fluid heated from below .... See Entry 66576

An experimental investigation of the wake of an axisymmetric body with a slanted base .... See Entry 66580

Similarities and differences in the nonlinear flow behavior of simple and of molecular liquids .... See Entry 66601

The dynamics of simple fluids in steady circular shear .... See Entry 66604

Frictional resistance in fiber suspensions. II. Flow on a rotating disk .... See Entry 66614

47.35 WAVES

66585 The pressure characteristics of random water waves. Yi-Ku.Kuo, Her-Yuan Chen (Dept. of Civil Engng., Nat. Chiao Tung Univ., Hsinchu, Taiwan).
J. Chin. Inst. Eng. (Taiwan), vol.6, no.1, p.1-8 (Jan. 1983).
An empirical formula is suggested by laboratory data to describe the relationship between surface wave heights and wave pressure fluctuations. This formula can not only be used in monochromatic waves, but also can determine the attenuation of random pressure fluctuations. The expected error is about 10%. Based on this fact, it is known that the linear superposition consideration is applicable to wave spectral model approximately even in the moderate shallow water region. On the other hand, from the existing experimental results, it has been shown that the statistical wave heights can be estimated through the transformation of the root-mean-square values of the wave pressure records to those of the water surface displacements. (11 refs.)

66586 Shallow water waves: conservation laws and symplectic geometry. Y.Akyildiz (Math. Sci., Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.27-8 (11 April 1983).
The author shows that shallow water equations on a sloping beach can be cast into hamiltonian form, that they have infinitely many polynomial conserved quantities in involution and that there are associated symplectic Backlund transformations. (3 refs.)

66587 Nonlinear interfacial progressive waves near a boundary in a Boussinesq fluid. D.I.Pullin (Dept. of Mech. Engng., Univ. of Queensland, St. Lucia, Queensland, Australia), R.H.J.Grimshaw.
Phys. Fluids (USA), vol.26, no.4, p.897-905 (April 1983).
The behavior of nonlinear progressive waves at the interface between two inviscid fluids in the presence of an upper free boundary is studied as a model of waves on the thermocline. A set of relationships between the integral properties of bounded waves in a general two-fluid model is first developed and the Stokes expansion to third order is derived. The exact free boundary problem for the wave profile is then formulated within the Boussinesq approximation as a nonlinear integral equation, which is solved numerically using two different numerical methods. For finite velocity difference across the two-fluid interface bifurcation of solutions into upper and lower branch wave profiles with quite different properties is obtained. Numerically calculated wave shapes and integral properties show good agreement with third-order Stokes expansion predictions in the weakly nonlinear regime for waves which are not too long. Very long waves were found to exhibit distinct solitary wave-like features. (15 refs.)

66588 Small-amplitude finite-rate waves in suspensions of particles in fluids. A.Kluwick (Tech. Univ. Wien, Wien, Austria).
Z. Angew. Math. & Mech. (Germany), vol.63, no.3, p.161-71 (1983).
Deals with the propagation of weakly nonlinear waves in homogeneous suspensions. Under the assumption that a one-dimensional treatment is adequate the properties of these waves are investigated in stable as well as unstable flow and near the stability limit. Special emphasis is placed on the discussion of waves of constant form. (34 refs.)

Main boundary-value problems for the equation for oscillations of a stratified liquid .... See Entry 66611

Experimental study on sluggish bubble behaviors in pressure waves .... See Entry 66612

A variational principle for surface waves in magnetohydrodynamics .... See Entry 66645

A statistical dynamical theory of strongly nonlinear internal gravity waves .... See Entry 69225

Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. I. Experiments .... See Entry 69226

47.40 COMPRESSIBLE FLOWS; SHOCK AND DETONATION PHENOMENA

(see also 28.70 Nuclear explosions, 52.35T Plasma shock waves)

66589 Effect of initial conditions on constant pressure mixing between two turbulent streams. S.Kangovi (Nat. Aeronautical Lab., Bangalore, India).
Aeronaut. Q. (GB), vol.34, pt.1, p.61-75 (Feb. 1983).
A study of the process of mixing and wake development has varied applications in wide ranging fields like jet ejectors, wake signatures, base pressure control, combustors, flow over cut-outs, jet noise and jet interactions. In real flows the wake is usually divided into two zones namely, the near field and the far field. The near field is usually controlled by initial conditions which involve two back-to-back boundary layers separating from the trailing edge of a solid surface. In the far field the flow becomes fully developed and assumes self similarity. The properties of fully developed far field have been well established but little is known about the near field. This paper describes the application of an integral analysis to study the effects of initial conditions like velocity ratio, initial boundary layer thickness, compressibility and temperature ratio on the development of near field of the turbulent mixing layer between two compressible, non-isoenergetic streams at constant pressure. Results include velocity and temperature profiles and the location of jet boundary line in the mixing layer. These results show the gradual approach of the mixing layer to self-preservation. (17 refs.)

66590 Compressible Rayleigh-Taylor instability. L.Baker (Mission Res. Corp., Albuquerque, NM, USA).
Phys. Fluids (USA), vol.26, no.4, p.950-2 (April 1983).
The role of compressibility in modifying the growth rate of Rayleigh-Taylor instability is discussed. Compressibility can either enhance or decrease the growth rate. If the sound speeds in the two media are the same, compessibility can still have an effect, in contrast to 'fist-order' theory. Compressibility becomes less important as the density ratio between the fluids increases. Experimental results have shown that compressibility can enhance growth rates compared to the incompressible value. (14 refs.)

Laminar compressible flow between close rotating disks. An asymptotic and numerical study .... See Entry 66552

Explosion-driven shock tubes (review) .... See Entry 66650

47.40D General subsonic flows

66591 Methods of loss estimation in compressible flow through pipe orifices and nozzles. Y.Torizumi, N.Hirayama, T.Maeda (Tokyo Metropolitan Univ., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.212, p.215-22 (Feb. 1983).
Compressibility effects on the characteristics of the flow through orifices and nozzles have been investigated, theoretically and experimentally, under the conditions of subsonic and supercritical flow regimes. A practical experimental formula is proposed by expressing the amount of loss as a ratio of loss coefficient of compressible flow case to that of incompressible flow case. The results of energy flow measurement indicate that the major part (60-70%) of the total dissipation energy arises within one-pipe diameter downstream of orifice. In addition, by measurements of the velocity and wall pressure, it is confirmed that the maximum pressure recovery does occur at 2 to 3 times the pipe diameter downstream of the reattachment point, and this location corresponds to the point where the irregularity of the velocity distribution due to the existence of orifice almost disappears. (10 refs.)

66592 Compressible three-dimensional stagnation point flow over a moving wall. R.Krishnaswamy, G.Nath (Dept. of Appl. Math., Indian Inst. of Sci., Bangalore, India).
Curr. Sci. (India), vol.52, no.3, p.118-20 (5 Feb. 1983).
The steady laminar compressible three-dimensional stagnation point flow over a moving wall with mass transfer has been studied and a three-dimensional analogue of two-dimensional separation has been presented. Both nodal and saddle point regions have been included in the analysis. The equations governing the flow have been solved numerically using an implicit finite-difference scheme. The effect of moving wall, mass transfer, compressibility and wall temperature on the flow field is found to be appreciable. (12 refs.)

Quasisteady arterial blood flow .... See Entry 68954

47.40H Transonic flows

66593 A vectorized finite element method for the computation of transonic tridimensional potential flows. C.Bonnet, Y.Vigneron, T.Lejal, O.Brocard, J.Bousquet.
Bull. Dir. Etud. & Rech. Ser. C (France), no.1, p.45-50 (1983). In French, English. (1^{er} Colloque International sur les Methodes Vectorielles et Paralleles en Calcul Scientifique (1st International Colloquium on Vectorial and Parallel Methods in Scientific Calculations), Paris, France, 17-18 March 1983).
An algorithm is described to compute transonic flows around complex shapes such as civil transport aircraft. The potential solution is obtained as the limit of the minimums of a sequence of modified pressure integrals. Finite elements are used to discretize the problem. The calculation of the 'gradients of the integrals to be minimized has been vectorized by the Cray-1 and Cyber 205 computers. Computing times are given for the Cray-1S, Cray-1M, Cray XMP, as well as for the CYBER 205, 2 and 4 pipes. They are compared with those obtained on the Cyber 170/750. (3 refs.)

Semi-elliptic computation of an axisymmetric transonic nozzle flow .... See Entry 66610

Multiprocessor computer modeling of transonic flow .... See Entry 66649

47.40K Supersonic and hypersonic flows

66594 Numerical simulation of a compressible turbulent boundary layer over a conductive wall with line heat source. D.Degani, A.Brosh (Technion-Israel Inst. of Technol., Haifa, Israel).
Comput. & Fluids (GB), vol.11, no.2, p.85-93 (1983).
A conjugated problem of supersonic turbulent flow over a conductive solid wall with an embedded line heat source has been investigated as a model of a separation detector and skin friction gage. The 2-D Navier-Stokes equations for compressible fluid, including a two layer eddy viscosity model, are solved simultaneously with the heat transfer equation for the solid, written in general coordinates. The effect of the interface boundary condition on the stability of the implicit scheme of the flow field has been checked. A careful investigation of the effect of heat source strength, solid and fluid conductivity and Mach and Reynolds numbers on flow and temperature fields has been performed. The results of this investigation may be used to design an optimal gage with a minimum influence on the flow field. (16 refs.)

Mechanism of pseudo-shock wave in supersonic jet .... See Entry 66605

47.40N Shock-wave interactions

66595 Characteristic method applied to blast waves in a dusty gas. F.Higashino (Stosswellenlabor, Rheinisch-Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.399-406 (April 1983).
The unsteady propagation of shock waves in a dusty gas is investigated theoretically. The characteristic equations are obtained without neglecting the effect of the partial pressure of the particles. Numerical computations were carried out by Hartree's technique. As examples, the flow in a shock tube and in a blast wave is examined by applying a generalized piston problem. The results show that the existence of suspended particles may cause a rapid decay of the shock strength and that the flow field is divided into several regimes which are characterized by the shock position and the relaxation times. (9 refs.)

Atomistic nonequilibrium computer simulations .... See Entry 66583

Mechanism of pseudo-shock wave in supersonic jet .... See Entry 66605

A self-similar flow of self-gravitating gas behind a shock wave with radiation heat flux. I .... See Entry 69485

A self-similar flow in generalised Roche model with radiation heat flux. II .... See Entry 69486

47.45 RAREFIED GAS DYNAMICS

(see also 07.30 Vacuum production and techniques)

66596 Asymmetries in evaporation and condensation Knudsen layer problems. T.Ytrehus (Norwegian Inst. of Technol., Trondheim, Norway).
Phys. Fluids (USA), vol.26, no.4, p.939-49 (April 1983).
Basic symmetries are shown to exist between half-space problems for evaporation and those for condensation, in the regime of linear transport. The asymmetry is determined by the normalized latent heat of the substance, which is found to have a critical influence upon the flow behavior in the condensation problem. The analysis is based upon the linearized Maxwell-Boltzmann transport equation, and the results indicate nonexistence of solutions to the condensation half-space problem for substances with latent heat below a certain critical value. (20 refs.)

66597 Flow of gases at low density through a packed bed. On the equivalent diameter and tortuosity factor. T.Kanki, S.Iuchi.
Rep. Himeji Inst. Technol. (Japan), no.35A, p.9-21 (1982). In Japanese.
Porous flow of gases at low density is studied on the basis of the equivalent capillary model. Based on the mean free path theory, the equivalent diameter is newly defined for free molecule flow as the ratio of molecular velocity to frequency of collisions of molecules with wall of porous structure. Despite the definition limited to the free molecule flow, the equivalent diameter is shown to be identical to Blake's one, $D_{eq}=4\epsilon/S_v(1-\epsilon)$ for continuum flow. In addition, a distribution law of radii of sectional area of spherical particles packed uniformly is deduced from statistical arguments and is applied to determine the tortuosity factor, which is given as a function of the porosity as $q=(2-\epsilon)^{3/4}$. Applying these results to the equivalent capillary model, expressions for permeability of gases through a packed bed are derived for free molecule, continuum, and transition flows. Also, the dependence of porosity on the Kozeny constant is briefly discussed. (13 refs.)

A similarity solution of the linearized Boltzmann equation with application to thermophoresis of a spherical particle .... See Entry 64860

47.50 NON-NEWTONIAN DYNAMICS

66598 Effect of small-amplitude harmonic vibrations on viscoelastic flows in a plane slider bearing. S.Zahorski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.1, p.73-88 (1982).
Considers the case of small-amplitude harmonic vibrations superposed on flow in a plane slider bearing (wedge flow), i.e. the situation fundamental in the lubrication theory. To discuss separately the influence of normal stresses and variable (apparent) viscosities on the lift and frictional forces in the bearing, the authors applied the model of viscoelastic second-order fluid and the simple model of viscous fluid with shear-dependent viscosity. A perturbation method proposed by Walters et al. (1971) is used to obtain effective solutions up to the second-order terms. The cases of moving slider and stationary base and vice versa as well as the mixed cases in which vibrations are acting either on the upper or the lower part of the bearing are discussed in greater detail. It is shown that normal stresses exert positive influence on the load capacity of the vibrating bearing, while the variable viscosity leads to an opposite effect. On the other hand, the frictional forces on moving and vibrating parts of the bearing are usually greater than in the case of purely Newtonian fluids. (12 refs.)

66599 Non-Newtonian behavior of polymeric liquids. R.B.Bird (Chem. Engng. Dept., Univ. of Wisconsin-Madison, Madison, WI, USA).
Physica A (Netherlands), vol.118A, no.1-3, p.3-16 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
A survey is given of the three main approaches to the study of the non-linear constitutive equations for polymer solutions and polymer melts: rheometric measurements in shear and elongational flows, continuum mechanics results for special flows and useful empiricisms; and molecular theories, including single-molecule theories for dilute solutions and network and reptational theories for melts. (33 refs.)

66600 Molecular dynamics simulations of the rheological properties of simple fluids. D.J.Evans (Res. School of Phys. Sci., Australian Nat. Univ., Canberra, Australia).
Physica A (Netherlands), vol.118A, no.1-3, p.51-68 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
Reviews some of the principal results obtained from non-equilibrium molecular dynamics simulations of Couette flow in fluids. The simulations show that even simple fluids exhibit a wide variety of non-Newtonian behaviour (e.g. viscoelasticity, shear thinning and dilatancy, normal stress differences and non-local momentum transport). The asymptotic dispersion relations for each of these effects is consistent with the non-analytic functional forms predicted using 'long-time-tail theories. However in each case, the magnitude of the observed effect is much larger than theoretical predictions. The author shows that non-linear irreversible thermodynamics successfully relates a number of these non-Newtonian effects observed, very far from equilibrium, outside the regime of local thermodynamic equilibrium. (47 refs.)

66601 Similarities and differences in the nonlinear flow behavior of simple and of molecular liquids. S.Hess (Inst. fur Theoretische Phys., Univ. Erlangen-Nurnberg, Erlangen, Germany).
Physica A (Netherlands), vol.118A, no.1-3, p.79-104 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
After the introduction of viscosity coefficients describing the non-Newtonian flow behavior and the normal pressure differences in a plane Couette symmetry, methods for the calculation of these coefficients are presented and some remarks on the connection with the linear viscoelasticity are made. The nonlinear flow behavior stems from the influence of the vorticity of the flow field and of the symmetric traceless shear rate tensor on the primary shear-rate-induced anisotropy of molecular distribution functions. In the case of molecular liquids the orientational distribution of the molecular axes (alignment) is the most relevant quantity; in simple liquids it is the pair-correlation function. Results are presented which can be inferred from an extended version of irreversible thermodynamics of molecular liquids; from a Fokker-Planck equation approach and for simple liquids, from a kinetic equation of Kirkwood-Smoluchowski type for the pair-correlation function. Finally, some modifications are discussed which lead to a nonanalytic shear-rate and frequency dependence as observed for the viscosity coefficients in the computer simulations. (77 refs.)

66602 Finite-amplitude periodic extensional flows. R.L.Powell (Dept. of Chem. Engng., Washington Univ., St. Louis, MO, USA).
Phys. Fluids (USA), vol.26, no.4, p.890-1 (April 1983).
By specializing the class of unsteady extensional flows considered by Slattery (1964) to motions which are periodic perturbations about a rest state and using the proper presentation for Noll's (1958) simple fluid undergoing such flows, explicit formulas for the induced stresses in terms of measurable material properties were achieved. It is found that oscillations of a sufficiently large amplitude will generate steady stresses in the fluid due to its nonlinear viscoelastic properties implying that orientation effects might be found in such flows. (9 refs.)

66603 Adiabatic shearing of incompressible fluids with temperature-dependent viscosity. C.M.Dafermos, L.Hsiao (Brown Univ., Providence, RI, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.45-58 (April 1983).
A convenient test problem for elucidating the effects of the dependence of viscosity on temperature is provided by adiabatic rectilinear shearing flow of an incompressible viscous fluid between two parallel plates. In this case the conservation equations are particularly simple and viscosity is the sole dissipative mechanism present. (2 refs.)

66604 The dynamics of simple fluids in steady circular shear. J.D.Goddard (Univ. of Southern California, Los Angeles, CA, USA).
Q. Appl. Math. (USA), vol.41, no.1, p.107-18 (April 1983).
An isotropic simple fluid of constant density ρ is confined between two infinite horizontal planes which rotate steadily about separate vertical (z) axes with common angular velocity ω. The author shows that at least one solution to the exact equations of motion is determined by the differential equation: $(\mathrm{d}/\mathrm{d}_z)(\eta[\mathrm{du}/\mathrm{dz}])i\rho\omega u=0$, where $u(z)$ is a complex variable representing the horizontal velocity and $\eta(|du/dz|, \omega)$ is a complex shear modulus. This equation represents the extension to nonlinear viscoelasticity of the previous works of R. Berker (1963) and of T.N.G. Abbott and K. Walters (1970) on linear viscoelastic fluids, for which η reduces to the usual dynamic viscosity $\eta^*(\omega)$. (15 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior .... See Entry 64582

Laminar flow of a non-Newtonian fluid in the thermal entrance region of a smooth pipe .... See Entry 66572

Free convection flow of a second-order fluid along a porous vertical plate with periodic suction .... See Entry 66577

Frictional resistance in fiber suspensions. I. Pipe flow .... See Entry 66613

Frictional resistance in fiber suspensions. II. Flow on a rotating disk .... See Entry 66614

Couette viscometry of Casson fluids .... See Entry 66653

47.55 NONHOMOGENEOUS FLOWS

Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics .... See Entry 64589

47.55B Cavitation

Non-linear behaviour and stability of trapped micron-sized cylindrical gas bubbles in an ultrasonic field .... See Entry 66423

Experimental study on sluggish bubble behaviors in pressure waves .... See Entry 66612

47.55C Jets

66605 Mechanism of pseudo-shock wave in supersonic jet. M.Nagai (Univ. of the Ryukyus, Okinawa, Japan).
Bull. JSME (Japan), vol.26, no.212, p.207-14 (Feb. 1983).
Concerning the overexpanded supersonic jet, interaction between the normal shock wave immediately downstream of the D'Laval nozzle exit and the shear layer of the jet boundary was investigated experimentally. The following were demonstrated. (1) The normal shock wave changes into a pseudo-shock wave immediately after its occurrence in the flow, (2) the pseudo-shock wave is several jet diameters in length but somewhat shorter than the pseudo-shock wave in duct flow, (3) its pressure ratio is extremely small compared with that of the normal shock wave and nearly proportional to the Mach number immediately upstream of the pseudo-shock wave. (16 refs.)

66606 An experimental investigation into the effect of changes in the geometry of a slot nozzle on the heat transfer characteristics of an impinging air jet. H.Hardisty (School of Engng., Univ. of Bath, Bath, England).
Proc. Inst. Mech. Eng. Part C (GB), vol.197, p.7-15 (March 1983).
High velocity, impinging, air jets are commonly user for heating, cooling, drying etc., because of the high heat transfer coefficients which occur in the impingement region. To provide data for design, a variety of slot nozzles has been tested to determine the effect on heat transfer of both nozzle shape and slot width. A small heat flux meter was used to measure local values of the heat transfer coefficient in the impingement zone, and these local values were integrated to yield space average values. As a necessary preliminary to the heat transfer investigation, the discharge coefficients of the nozzles were measured. From the first test series it was found that heat transfer results from differently shaped nozzles could be satisfactorily correlated provided that the effective slot width was used to characterize nozzle shape. From the second test series it was found that for geometrically similar arrangements, narrower slots gave higher heat transfer coefficients. (12 refs.)

66607 Efficiency of combined jet cooling of a plate in conditions of complex heat transfer. V.V.Glazkov, M.D.Guseva, B.A.Zhestkov, V.P.Lukash.
High Temp. (USA), vol.20, no.4, p.575-82 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.692-9 (July-Aug. 1982). [received: April 1983]
The conditions in which the relative flow rate of coolant used to create the projective jet for combined jet cooling of a wall as a minimum are determined. The general cases of wall cooling with complex heat transfer, combined jet cooling in conditions of convective heat transfer, jet cooling of a nonheat-conducting wall heated by a radient heat flux, and jet cooling of a heat-conducting wall are considered. Experimental and calculated values of the wall temperature are compared in the case of combined jet cooling with complex heat transfer. (10 refs.)

66608 Eddy viscosity in axially symmetric, swirling jets. S.Drobniak (Politech. Czestochowska, Czestochawa, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.477-90 (1981). In Polish.
The results are presented of experiments carried out in order to find the evolution of eddy viscosity in swirling jets. The existence of a semi-preserving region has been proved in this kind of flow and the behaviour of a turbulent Reynolds number has also been checked. (9 refs.)

66609 A theoretical prediction of the fluid buckling frequency. J.O.Cruickshank (Res. Div., Carrier Corp., Syracuse, NY, USA).
Phys. Fluids (USA), vol.26, no.4, p.928-30 (April 1983).
A simple theoretical model of the coiling frequency for a buckled axisymmetric fluid jet is developed. The special case of a jet dominated by viscous and gravity forces is considered, and the theoretical prediction is compared with experimental data. (4 refs.)

A two-equation turbulence model for two-phase flows ....See Entry 66622

Measurement of the velocity of axisymmetric laminar flow by an optical visualisation technique with coherent light ....See Entry 66658

Instrument for measuring dynamic surface tension ....See Entry 66659

47.55E Nozzles

66610 Semi-elliptic computation of an axisymmetric transonic nozzle flow. M.Rizk, M.A.Serag-Eldin, A.Mobarak (Dept. of Mech. Engng., Cairo Univ., Giza, Egypt).
Appl. Math. Modelling (GB), vol.7, no.2, p.123-7 (April 1983).
A newly developed, semi-elliptic computational algorithm is employed to predict the transonic flow inside an axisymmetric, convergent-divergent nozzle featuring small wall radius of curvature at the throat. The predictions obtained are compared against flow measurements for this nozzle, which have been reported elsewhere. Good agreement between the corresponding measurements and predictions is revealed, thus validating the computational algorithm and demonstrating its value as a design tool. (8 refs.)

Methods of loss estimation in compressible flow through pipe orifices and nozzles ....See Entry 66591

An experimental investigation into the effect of changes in the geometry of a slot nozzle on the heat transfer characteristics of an impinging air jet ....See Entry 66606

47.55H Stratified flows

66611 Main boundary-value problems for the equation for oscillations of a stratified liquid. S.A.Gabov, P.V.Shevtsov.
Dokl. Akad. Nauk SSSR, vol.268, no.6, p.1293-6 (1983). In Russian.
Some results (6 theorems) are reported, obtained with the aid of potential theory methods, relating to the classical solvability of the main initial-boundary problems for the second-order partial differential equation for small oscillations of an exponentially stratified liquid. (3 refs.) *F.Q.*

Flow through a small break at the bottom of a large pipe with stratified flow . ...See Entry 65508

The application of a charnock-based estimate of interfacial stress to some near-horizontal, stratified two-phase flows ....See Entry 65515

Flow of a stratified fluid in channels and pipes ....See Entry 66629

47.55K Multiphase flows

66612 Experimental study on sluggish bubble behaviors in pressure waves. H.Kimoto (Osaka Univ., Osaka, Japan), T.Fujii, T.Hirose.
Bull. JSME (Japan), vol.26, no.212, p.223-30 (Feb. 1983).
By means of high-speed photography and pressure transducers, the motion of a gas- or a vapour-slug bubble is observed in pressure waves. The velocity of a water jet, formed at the spherical top surface of a slug bubble, is measured on the high-speed photographs, and it is confirmed that the velocity is less than 10 m/s even in the case of a vapour slug bubble, and that the pulsation of the gas slug bubble in the pressure waves is treated as an adiabatic one. Moreover, the impact pressure of the water jet against the pressure transducer, set in the gas slug bubble, is measured, and it is also confirmed that the value is the same as the one, estimated by the stagnation pressure of the water jet. (10 refs.)

66613 Frictional resistance in fiber suspensions. I. Pipe flow. H.Kato, H.Mizunuma (Tokyo Metropolitan Univ., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.212, p.231-8 (Feb. 1983).
Viscous properties and pipe flow resistance of fiber suspensions are experimentally investigated. The authors employ several synthetic fibres with various aspect ratios and microscopic asbestos fibers. The viscosity of fiber suspensions decreases with an increasing shear rate but it exhibits Newtonian viscous behavior at very high shear rate. The viscous property of synthetic fiber suspensions is correlated experimentally to the aspect ratios. In synthetic fibers, turbulent drag reduction is due to an increase in log profile's gradient. This increase is affected by their stiffness, aspect ratio, concentration and others. Their correlation is experimentally determined. In asbestos fibers, thickening of viscous and buffer layers also contributes to the drag reduction. (6 refs.)

66614 Frictional resistance in fiber suspensions. II. Flow on a rotating disk. H.Mizunuma, H.Kato (Tokyo Metropolitan Univ., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.212, p.239-46 (Feb. 1983).
For pt.I see ibid., vol.26, no.212, p.231-8 (1983). The frictional moment in fiber suspensions is measured to investigate experimentally the flow on a rotating disk. In laminar region and in case of aspect ratio beyond 200, the fiber flocculence increases the frictional resistance. In turbulent region, the drag-reduction increases with the aspect ratio. Though the effect of disk diameter is little, the drag reduction increases with the diameter. These phenomena are correlated with those in pipe flow. (9 refs.)

66615 The Faxen formulae for a rigid particle in an unsteady non-uniform Stokes flow. R.Gatignol (Lab. de Mecanique Theorique, Univ. Pierre-et-Marie-Curie, Paris, France).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.143-60 (1983).
A method for calculating the drag and torque of a solid particle moving non-uniformly in an unsteady stream of viscous incompressible fluid is proposed. The problem is formulated in a conventional way in a frame linked to the particle. By using the Fourier transform and some reciprocity formulae the drag and the torque are deduced from knowledge of the normal stress vector on the particle in very simple flows. The results are given explicitly for the case of a spherical particle and are in agreement with the formulae known in various special cases. (30 refs.)

66616 Turbulent heat transfer on the surface of a steam-chugging bubble. C.K.B.Lee (R&D Associates, Marina del Rey, CA, USA).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.25-37 (Jan.-Feb. 1983).
The length and velocity scales of the turbulent eddies at the surface of a type of steam-chugging bubble (the detached bubble) are derived from a physical model. The corresponding turbulent heat transfer result, which contains no free parameters, is $\mathrm{Nu}=0.04$, $\mathrm{Re}^{7/8}$, $\mathrm{Pr}^{1/2}$. A comparison with the available experimental data shows excellent agreement. (13 refs.)

66617 Numerical optimization studies of axisymmetric unsteady sprays. S.K.Aggarwal, G.J.Fix, D.N.Lee, W.A.Sirignano (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Comput. Phys. (USA), vol.50, no.1, p.101-15 (April 1983).
A hybrid numerical technique is developed for the treatment of axisymmetric unsteady spray equations. An Eulerian mesh is employed for the parabolic gas-phase subsystem of equations while a Lagrangian scheme (or method of characteristics) is utilized for the droplet equations. The integration schemes and the scheme for interpolation between the two meshes are demonstrated to be second-order accurate. The effects of interesting numerical parameters such as mesh size, number of droplet characteristics, time step, and the injection pulse time are determined via a parameter study. (7 refs.)

66618 On a mathematical model of colmatage process in cracks and its application. O.Cieslicki (Politech. Warszawska, Inst. Automatyki Przemyslowej, Warsaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.385-95 (1981). In Polish.
Presents the phenomenological model of a phenomenon accompanying the flow of suspension through a micro-gap. The phenomenon is called the colmatage process and depends on trapping the dispersion phase particles. The particles being trapped in the gap divide its area into separate segments. It was assumed that a single particle stopped in the crack segment can divide or remove the segment, depending on the mutual dimensions. The number of segments—C and the characteristic dimension of flow width—L after flow of the volume V of liquid have been calculated. The analysis is based on the computer solved results of the set of formulated, nonlinear differential equations. Also the approximate, analytical solution of the set has been obtained. (7 refs.)

66619 The effect of Brownian motion on the transport properties of a suspension of spherical particles. B.U.Felderhof (Inst. fur Theoretische Phys., Tech. Hochschule Aachen, Aachen, Germany).
Physica A (Netherlands), vol.118A, no.1-3, p.69-78 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
Discusses the effect of Brownian motion on the transport properties of a suspension of spherical particle immersed in an incompressible fluid satisfying the equations for creeping flow. The author derives a Smoluchowski equation for the probability distribution in the particle configuration space with time-dependent imposed flow and applied forces. It is shown that retardation of the distribution function gives rise to a frequency dependence of the effective viscosity of the suspension. (23 refs.)

66620 Growth law dynamics in a phase separating fluid. R.C.Desai, S.W.Koch, F.F.Abraham (IBM Res. Lab., San Jose, CA, USA).
Physica A (Netherlands), vol.118A, no.1-3, p.136-43 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
From a molecular dynamics experiment of an unstable two-dimensional fluid undergoing phase separation, the authors observe two principal growth regimes: (1) spinodal decomposition with a wavelike morphology followed by (2) a transition to cluster formation and growth due to atomic condensation and cluster coagulation. In the second regime the growth law is $t^{1/2}$. This dependence arises from the isothermal growth law for vapor accretion on two-dimensional clusters in a 'one' component supersaturated vapor. The details of theoretical analysis that leads to $t^{1/2}$ growth law are presented. (4 refs.)

66621 Equation of motion for a small rigid sphere in a nonuniform flow. M.R.Maxey (Dept. of Chem. Engng., Johns Hopkins Univ., Baltimore, MD, USA), J.J.Riley.
Phys. Fluids (USA), vol.26, no.4, p.883-9 (April 1983).
The forces on a small rigid sphere in a nonuniform flow are considered from first principles in order to resolve the errors in Tchen's equation and the subsequent modified versions that have since appeared. Forces from the undisturbed flow and the disturbance flow created by the presence of the sphere are treated separately. Proper account is taken of the effect of spatial variations of the undisturbed flow on both forces. In particular the appropriate Faxen correction for unsteady Stokes flow is derived and included as part of the consistent approximation for the equation of motion. (24 refs.)

66622 A two-equation turbulence model for two-phase flows. S.E.Elghobashi, T.W.Abou-Arab (Dept. of Mech. Engng., Univ. of California, Irvine, CA, USA).
Phys. Fluids (USA), vol.26, no.4, p.931-8 (April 1983).
A two-equation turbulence model has been developed for predicting two-phase flows. The two equations describe the conservation of turbulence kinetic energy and dissipation rate of that energy for the carrier fluid in a two-phase flow. They have been derived rigorously from the momentum equations of the carrier fluid. Closure of the time-mean equations is achieved by modeling the turbulent correlations up to third order. The new model eliminates the need to simulate in an ad hoc manner the effects of the dispersed phase on turbulence structure. Preliminary testing indicates that the model is successful in predicting the main features of a round gaseous jet laden with uniform-size solid particles. (33 refs.)

66623 A note on the Stokes resistance tensors of multiparticle systems in shear fields. S.Haber (Faculty of Mech. Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.246-52 (March 1983).
The Stokes resistance tensors (material tensors) of a multiparticle system subjected to a general shear flow depends on the spatial configuration of the particles, their shape, size and location of some arbitrarily fixed set of points locked to the particles by which their linear velocities are traced. The objective of the work is the determination of some symmetry properties of the material tensors and the transformation laws which govern them under translation of the set of points fixed to the particles. (8 refs.)

66624 Computer simulation of laminar dilute suspension flows in asymmetric pressure-driven membrane units. C.Kelinstreuer, M.S.Paller, T.P.Chin (Dept. of Chem. & Environmental Engng., Rensselaer Polytech. Inst., Troy, NY, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.55-8 vol.3
A computer simulation model for steady laminar dilute suspension flow in a channel with one permeable wall has been developed. Reduced forms of the mass transport and momentum equation were solved simultaneously to study the effects of system parameters and transport mechanisms on permeation flux decline. Unique features of the model include: (1) the use of a subchanneling technique with which the strong coupling betwe en theequation of motion and the convection-diffusion equation is incorporated, (2) the asymmetry of the flow field, and (3) the fact that some of the boundary conditions are unknown a priori in the 'marching' routine. The computer simulation model is a useful tool for system investigations, sensitivity analyses and predictive case studies towards optimal design. (28 refs.)

66625 The effect of rate of expansion on the condensation of supersonic wet steam flow in a Laval nozzle. Yi-nian Cai, Yao Huang (Xi'an Jiaotong Univ., China).
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.254-61 vol.1
The authors present a summary of one aspect of the research work that has recently been done on the nucleation of condensing wet steam flow in an experimental Laval nozzle. By way of such a summary, it is possible to picture the outlook for further research in this direction which is very closely related to the development of nuclear power generation in China. (15 refs.)

66626 Pressure drop and flow characteristics of two-phase flow in porous media with distinct permeability regions. H.S.Lee, I.Catton (School of Engng. & Appl. Sci., Univ. of California, Los Angeles, CA, USA), H.L.Sullivan.
Thermal-Hydraulics of Nuclear Reactors. Second International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Santa Barbara, CA, USA, 11-14 Jan. 1983 (LaGrange Park, IL, USA: ANS 1982), p.904-9 vol.2
An experiment has been performed where the pressure drop and void fraction of two phase flow in a porous media have been measured. A multilayered structure of isotropic materials serves as the porous media. The beds of uniform glass spheres of different sizes are packed adjacently to give the regions different but uniform permeabilities. The experiment is modeling the degraded core in a nuclear reactor which could form following a severe accident. The pressure drop in such a two phase flow system is one of the primary concerns. The migration of vapor to a region of low permeability (or high permeability) could be very important in determining the coolability of the degraded core. For each porous media configuration, results are presented for the pressure drop as a function of superficial velocities of the fluids. The interplay of the distinct permeability regions on two-phase flow is observed and reported. (16 refs.)

Two-phase flow instability in channels with sinusoidal heat supply .... See Entry 65485

Detailed modelling of two phase flow and its application to system prediction .... See Entry 65498

Radionuclide scrubbing in water pools: bubble hydrodynamics .... See Entry 65504

Two-phase redistribution in horizontal subchannel flow—turbulent mixing and gravity separation .... See Entry 65505

A comparison of flow regime behaviour in adibatic and diabatic two-phase flow trefoil simulations .... See Entry 65506

Two-phase instability in nozzle flows of bubbly liquid .... See Entry 65507

Flow through a small break at the bottom of a large pipe with stratified flow .... See Entry 65508

Flooding experiments in tubular geometry with steam-water up to 70 bar .... See Entry 65509

Parameters for the scaling of oscillatory two-phase flows .... See Entry 65510

De-entrainment of liquid on vertical rods in air-water cross flow .... See Entry 65511

Drop motion and deposition in annular two-phase flow .... See Entry 65512

Some details of developing slugs in horizontal two-phase flow .... See Entry 65514

The application of a charnock-based estimate of interfacial stress to some near-horizontal, stratified two-phase flows .... See Entry 65515

Wave dispersion effects in two-phase flow .... See Entry 65516

Shock phenomena in a one-component two-phase bubbly flow .... See Entry 65517

Dryout and post-dryout heat transfer in helically coiled tubes .... See Entry 65519

Application of multi-fluid model in dryout prediction .... See Entry 65530

Steam density oscillations in two phase-two component flow .. See Entry 65636

An analysis of multiple bubble behaviors in a BWR suppression pool .... See Entry 65638

On the growth of large spherical sodium vapor bubbles in a liquid sodium pool .... See Entry 65650

Mathematical models of the methods for calculations of shape and tensile forces in moving thread systems .... See Entry 66545

Mass transfer between a suspension of fibres and a rotating disk .... See Entry 66550

Water absorption by a solution of lithium bromide in wetted wall columns with tangential feed .... See Entry 66564

Forced flow cooling studies of volumetrically heated porous layers .... See Entry 66579

Small-amplitude finite-rate waves in suspensions of particles in fluids .... See Entry 66588

Characteristic method applied to blast waves in a dusty gas ... See Entry 66595

Dielectrophoretic motion of bubbles in liquid .... See Entry 66642

The spatial filtering effect of capacitance transducer electrodes [flow measurement] .... See Entry 66652

47.55M Flow through porous media

66627 On the moisture movement in hygroscopically-porous material during the falling rate drying period. M.A.Kusumowardhoyo (Mech. Engng. Dept., Inst. of Technol. Bandung, Bandung, Indonesia).
Int. Commun. Heat & Mass Transfer (GB), vol.10, no.1, p.39-48 (Jan.-Feb. 1983).
A new concept of moisture transfer in hygroscopically-porous material during drying is proposed. The drying model developed gives simulation results which are in a very good agreement with experiments. (2 refs.)

66628 Collocation simulator for a system of coupled transport operators. V.V.Nguyen (Dept. of Civil Engng., Princeton Univ., Princeton, NJ, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.300, vol.2
Summary form only given, as follows. A mathematical description of the transport of chemicals in reactive porous media consists of a set of coupled quasilinear partial differential equations. This set of equations may be systematically decomposed into two kinds of operators and subsequently solved using an iterative collocation simulator. The associated standard error bounds are derived. The influence of the quasilinear terms upon the iteration scheme will also be investigated. (no refs.)

Effects of variable physical properties on free convection in a porous insulating layer .... See Entry 66561

Heat transfer by natural convection in a vertical porous layer .... See Entry 66565

Loss of stability condition for free convection in a porous layer .... See Entry 66573

Natural convection with transpiration over a vertical porous plate at high temperature. Effects of a nonuniform blowing .... See Entry 66575

Flow of gases at low density through a packed bed. On the equivalent diameter and tortuosity factor .... See Entry 66597

Computer simulation of laminar dilute suspension flows in asymmetric pressure-driven membrane units .... See Entry 66624

Pressure drop and flow characteristics of two-phase flow in porous media with distinct permeability regions .... See Entry 66626

MHD free-convection flow in the Stokes problem for a porous vertical plate by finite difference method .... See Entry 66634

The measurement of emulsion phase voidage in gas fluidized beds of fine powders .... See Entry 68804

47.60 FLOWS IN DUCTS, CHANNELS, AND CONDUITS

(for biological fluid dynamics, see 87.45)

66629 Flow of a stratified fluid in channels and pipes. V.P.Shidlovsky, L.I.Turchak (Computing Centre, Acad. of Sci., Moscow, USSR).
Arch. Mech. (Poland), vol.34, no.1, p.5-14 (1982).
A new derivation is presented for a set of equations describing the flow of viscous, heat conducting, salted and stratified fluid, based on the Boussinesq approximation. These equations are applied to study flows of stratified fluid in vertical channels and pipes, caused by thermal convection or pressure gradient. The effect of stratification results in appearance of a boundary layer. (11 refs.)

66630 Experimental determination of the random lump-age distribution in the boundary layer of the turbulent pipe flow using laser-Doppler anemometry. H.R.E.Van Maanen (Koninklijke/Shell Lab., Amsterdam, Netherlands), J.M.H.Fortuin.
Chem. Eng. Sci. (GB), vol.38, no.3, p.399-423 (1983).
Local velocities in the boundary layer of a fully-developed turbulent water flow in a horizontal, straight, smooth, 50 mm dia. tube were measured at 15, 20 and 30°C, and at $Re=5000$, $Re=9500$ and $Re=20000$ with a laser-Doppler velocimeter, accessory optics and a data processing system. Velocities in axial and radial directions at fixed positions near the wall were measured and their fluctuations were attributed to bursts and background turbulence. Each burst is considered as a spontaneous replacement of a liquid lump on the wall by a fluid entity from the bulk; background turbulence is considered as noise. For the velocity fluctuations in the axial direction an adequate procedure was applied to discriminate between bursts and noise. The values of a large number of time intervals between successively detected bursts were measured and presented in histograms. Further the time-averaged velocity

profile in the boundary layer and the velocity profile near the wall just after the moment that a burst occurs, were determined experimentally. (20 refs.)

66631 Secondary instability of plane channel flow to subharmonic three-dimensional disturbances. T.Herbert (Dept. of Engng. Sci. & Mech., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA).
Phys. Fluids (USA), vol.26, no.4, p.871-4 (April 1983).
A linear secondary instability mechanism is presented that leads to the occurrence of subharmonic three-dimensional disturbances in wall-bounded shear flows. The instability originates from the periodic redistribution of vorticity in the shear flow by small but finite-amplitude Tollmien-Schlichting waves. Low threshold amplitudes and other characteristics of this instability are consistent with experiments and may elucidate various obscure observations. (17 refs.)

66632 Numerical studies on a confined channel flow. K.Murai, K.Ohta, M.Sasakura, M.Nakagawa, Y.Kawashima.
Rep. Himeji Inst. Technol. (Japan), no.35A, p.22-39 (1982). In Japanese.
The flow characteristics and flow pattern of two-dimensional confined channel have been studied. It is so difficult to obtain an analytical solution that a direct numerical solution of the Navier-Stokes equations in finite difference form for laminar flow is proposed under simplified conditions, and for turbulent flow, Reynolds stresses are assumed to be related to the mean strains by a scalar eddy viscosity, and numerical solutions are obtained. In a case of turbulent flow, the momentum equations, the equation which links the vorticity and the stream function, and that for the turbulent energy k are solved simultaneously in finite difference form. Finite difference equations are derived by integration of the fundamental differential equations over finite area. The flow patterns obtained by numerical calculation are in agreement with that of the experimental results. (5 refs.)

66633 An application of adjoint variational method to the capillary instability in liquid. Xu Shuochang (Inst. of Mech., Acad. Sinica, Beijing, China).
Sci. Sin. (China), vol.26, no.3, p.284-96 (March 1983).
Applying the direct variational approach of first-order approximation to the capillary instability problem for the cases of rotating liquid column, toroid and films on both sides of cylinder, the author obtains the necessary and sufficient conditions for motion stability of the 'cylindrical core-liquid-liquid-cylindrical shell' systems. The results obtained before are found to be special cases of the present investigation. The author has also explained the physical essence of rotating instability. (19 refs.)

Measurement of friction factors for the flow of gases in very fine channels used for microminiature Joule-Thomson refrigerators .... See Entry 64910

Turbulent diffusion of mass in circular pipe flow ....See Entry 66558

Heat transfer enhancement in oscillatory cavity flow ....See Entry 66563

Water absorption by a solution of lithium bromide in wetted wall columns with tangential feed .... See Entry 66564

Investigation of flow distribution in cells with triangular tubular bundles ....See Entry 66568

Calculation of heat transfer in smooth pipes with turbulent flow of gaseous heat-carriers with constant and variable physical properties ....See Entry 66569

Laminar flow of a non-Newtonian fluid in the thermal entrance region of a smooth pipe .... See Entry 66572

Heat induced flow effects on heat transfer properties of a pulsed superconductor ....See Entry 66578

Methods of loss estimation in compressible flow through pipe orifices and nozzles ....See Entry 66591

Characteristic method applied to blast waves in a dusty gas ... See Entry 66595

Frictional resistance in fiber suspensions. I. Pipe flow ....See Entry 66613

Computer simulation of laminar dilute suspension flows in asymmetric pressure-driven membrane units .... See Entry 66624

Flow of an electrically conducting liquid in a pipe with a longitudinal magnetic field ....See Entry 66639

Evaluation of MHD-processes in saline coolants ....See Entry 66644

Flow of liquid cathodes in three-dimensional magnetic fields .. See Entry 66646

Numerical solution of the two-dimensional equations of laminar flame propagating down a cylindrical tube .... See Entry 66647

Multiprocessor computer modeling of transonic flow ....See Entry 66649

Measurement of the velocity of axisymmetric laminar flow by an optical visualisation technique with coherent light .... See Entry 66658

Experimental study of the heat fluxes in a MHD channel ....See Entry 68895

Quasisteady arterial blood flow .... See Entry 68954

47.65 MAGNETOHYDRODYNAMICS AND ELECTROHYDRODYNAMICS

(for MHD in plasma, see 52.30)

66634 MHD free-convection flow in the Stokes problem for a porous vertical plate by finite difference method. A.K.Singh (Dept. of Math., Banaras Hindu Univ., Varanasi, India).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.67-74 (Feb. 1983).
The flow past an infinite vertical isothermal plate started impulsively in its own plane in a viscous incompressible and electrically conducting fluid has been considered. The magnetic Reynolds number is assumed small so that the induced magnetic field can be neglected. The governing equations of the flow are solved by a finite-difference method when the Prandtl number is not equal to unity. The influence of the various parameters, entering into the problem, on the velocity field, the temperature field and on their related quantities is extensively discussed with the help of graphs and tables. (4 refs.)

66635 Motion of a fluid around a cylinder of any conductivity due to crossed magnetic and electric fields. P.Marty, A.Alemany (Inst. de Mecanique de Grenoble, Centre di Tri, Grenoble, France).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.227-43 (1983). In French.
Studies the perturbation due to the presence of an infinitely long cylinder, of any electrical conductivity, immersed in liquid metal subjected to a homogeneous magnetic field and an electric current which are perpendicular to each other. Calculations are made for three configurations: the cylinder is parallel (i) to the electric current, (ii) to the magnetic field, and (iii) to the force field. In this last case an induced flow around the obstacle appears. This flow is studied for asymptotic values of the Hartmann number, M. When $M \ll 1$, the flow, directed along the cylinder axis, is arranged in four cells of equal area. When $M \gg 1$, a singular perturbation technique is used and it is shown that the flow is also directed along the cylinder axis and is invariant in the direction of the magnetic field. In each case, the acting force is expresed as a function of the electrical conductivities of the fluid and of the obstacle. (15 refs.)

66636 Rayleigh-Taylor instability of a fluid supported against gravity by an oscillating magnetic field. B.B.Chakraborty (Dept. of Chem. Technol., Bombay Univ., Bombay, India), H.K.S.Iyengar, A.R.Hayak.
J. Math. Phys. (USA), vol.24, no.5, p.1326-31 (May 1983).
Rayleigh-Taylor instability of an incompressible, inviscid, and infinitely conducting heavy fluid supported against gravity by a horizontal and uniform magnetic field is studied. The magnetic field consists of a steady part and an unsteady part, of magnitude varying with time, rotating with a fixed period about a vertical axis. The growth rate of instability of any unstable disturbance is obtained analytically when the magnitude of the unsteady part of the field is small. When the unsteady part of the field is not small, the growth rate is calculated numerically. The analytical as well as the numerical results show that, except in some special cases, the steady and the unsteady field components together have greater stabilizing influence on the fluid than in the case when the unsteady field is acting alone. A physical explanation of the stabilizing influence of the combined presence of the steady and unsteady field is suggested. (14 refs.)

66637 Theory of an almost toroidal dynamo. E.P.Kropachev.
Magnetohydrodynamics (USA), vol.18, no.3, p.220-6 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.14-20 (July-Sept. 1982). [received: April 1983]
The kinematic theory of magnetic field production in the motion of a conducting liquid is based on examining the induction equation of magnetohydrodynamics with a given velocity field. The problem consists in elucidating what motion of the conducting liquid in a certain finite volume will give rise to a magnetic field that tends to zero at large distances but which does not vanish with the lapse of time. An approach is available for certain important classes of hydrodynamic motion in a conducting liquid such as almost axially symmetrical ones and small-scale turbulent gyrotropic motion. The author considers the generation of a magnetic field in a sphere when the main flow of the liquid is toroidal but there is no axial symmetry in the motion. Generation of a magnetic field is impossible for a purely toroidal motion (Bullard's antidynamo theorem). Minor radial deviations in the velocity can naturally give rise to conditions for magnetic field generation. The character of these conditions is examined. (4 refs.)

66638 Nonlinear self-excited oscillations in MHD flows. A.G.Bershadskii.
Magnetohydrodynamics (USA), vol.18, no.3, p.245-9 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.42-6 (July-Sept. 1982). [received: April 1983]
Recently acquired experimental data on the stability of shear MHD flows contradict the accepted theory of self-excited oscillations in a fluid. Both versions of the theory predict that the amplitude of self-excited oscillations will be proportional to $\sqrt{\delta}$, where δ is the supercriticality parameter. In experiments on the stability of shear MHD flows, however, a linear dependence of the amplitude on δ is obtained for small values of δ. The indicated theories well describe simple self-excited oscillations, but the investigation of coupled self-excited oscillations requires more realistic methods for their investigation. Such a method is proposed. For simple self-excited oscillations this method yields the same fundamental results as the conventional theories. For self-excited doublets the new method gives a linear dependence of the amplitude and frequency on the small supercriticality parameter. The conditions are determined for the existence of subcritical and supercritical self-excited doublets, and expressions are derived for calculating their amplitudes and frequencies. (7 refs.)

66639 Flow of an electrically conducting liquid in a pipe with a longitudinal magnetic field. L.G.Genin, T.E.Krasnoshchekova.
Magnetohydrodynamics (USA), vol.18, no.3, p.258-63 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.57-62 (July-Sept. 1982). [received: April 1983]
For flow in a longitudinal magnetic field, the Hartman effect related to the flattening of the average velocity profile is absent and the only effect stemming from the action of the magnetic field on the flow is suppression of turbulent pulsations. In addition, the hydraulic resistance and heat transfer also decrease. There are a large number of computational-theoretical papers in which available experimental data are used to construct semiempirical models of turbulent MHD flows. However, until now, the available experimental data have not been carefully compared and generalized. The authors attempt such a generalization. Based on a single dependence for the coefficient of turbulent diffusion of momentum, they were able to describe with good accuracy the available experimental data on velocity profiles and drag for flow of an electrically conducting fluid in a longitudinal magnetic field. (10 refs.)

66640 Experimental studies of electroconvective motion in transformer oil. A.I.Fedonenko, A.I.Zhakin.
Magnetohydrodynamics (USA), vol.18, no.3, p.272-6 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.74-8 (July-Sept. 1982). [received: April 1983]
Experimental data is presented on development and kinematic characteristics of electrical convection over a wide range of intensity of the external electric field (from uniform to strongly nonuniform) in a liquid dielectric with varying electrical conductivity. (13 refs.)

66641 EHD-flow in system with mutually parallel shells. Yu.K.Stishkov, A.A.Ostapenko, N.A.Chistyakov.
Magnetohydrodynamics (USA), vol.18, no.3, p.277-80 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.79-83 (July-Sept. 1982). [received: April 1983]
Study of EHD flow in systems with mirror-symmetric electrodes is of profound scientific interest, since it would in a clear manner reveal the basic characteristics of EHD flow modes, their polar diversities and their dependence on the electrophysical properties of the medium. The author presents results of an experimental study of EHD flow in a system with 'wire-wire' electrodes. The main experiments were performed in a vessel made of acrylic glass. In a similar vessel, but with through passage, was studied the development of straight-through flow. (2 refs.)

66642 Dielectrophoretic motion of bubbles in liquid. A.B.Isers.
Magnetohydrodynamics (USA), vol.18, no.3, p.280-3 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.83-6 (July-Sept. 1982). [received: April 1983]
One of the problems under conditions of near weightlessness is removal of gaseous inclusions from liquid fuel. Inasmuch as most working liquids are liquid dielectrics, it maybe possible to remove bubbles by means of a nonuniform electric field. The polarization forces appearing due to difference between the dielectric permittivity of the liquid and that of the gas produce a so-called dielectrophoretic motion of bubbles in the liquid. Since under real conditions clusters of bubbles are to be removed, it is worthwhile to examine the interaction between bubbles upon application of an electric field and, first

of all, pairwise interaction. Such interaction is the object of the study. (4 refs.)

66643 Compensation of induced magnetic fields at high magnetic Reynolds number. A.M.Anisimov, V.F.Vasil'ev, I.V.Lavrent'ev.
Magnetohydrodynamics (USA), vol.18, no.3, p.299-304 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.105-10 (July-Sept. 1982). [received: April 1983]
As the magnetic Reynolds number ($N_{Re,m}$) increases, the efficiency of various MHD devices (generators, pumps, throttles, flow meters) decreases appreciably because of the negative effect of the magnetic fields of currents induced in the channel. Various methods of compensating these induced fields have been proposed for reducing this effect. The most widely adopted one is use of a return current conductor or a two-channel (bifilar) MHD device with two identical channels inside the gap of the magnet system, where the working medium as well as the electric current flow in opposite directions. It has been demonstrated on the basis of two-dimensional theory that compensation by means of a return current conductor in a channel without barriers is ineffective: as$N_{Re,m}$ increases, the electrical power delivered by a generator channel and the mechanical power delivered by a pump channel decrease appreciably, even though the maximum attainable electromagnetic efficiency of the channel remains at the same level as $N_{Re,}=Re_m$ in the noninductive approximation ($N_{Re,m}=0$). A bifilar device, on the other hand, is assumed to provide full compensation and the characteristics of its channels are described by the inductionless theory. This is not so and a bifilar device is not one ensuring full compensation of induced magnetic fields. Furthermore, an increase of $N_{Re,m}$ is accompanied by a decrease of the resultant magnetic field within the active zone under the inductor, the amount of this decrease becoming larger as the magnet system is made shorter. This effect is closely linked to the three-dimensionality of the electromagnetic field distribution and its rigorous description is possible only with a solution to the three-dimensional problem. (6 refs.)

66644 Evaluation of MHD-processes in saline coolants. A.D.Votsish.
Magnetohydrodynamics (USA), vol.18, no.3, p.322-5 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.129-32 (July-Sept. 1982). [received: April 1983]
The main problem in the design of heat exchanger systems based on liquid coolants in a strong magnetic field (6-8 T) is, from the MHD standpoint, determining the decrease of hydraulic pressure drop and the increase of heat transfer in streams of conducting liquids in magnetic fields. An examination of designs of such systems reveals an appreciable effect of a magnetic field on the stream of liquid. In one design, for instance, the pressure drop can vary over a range of six orders of magnitude from 0.1 to 10^5 N/cm^2, depending on the channel geometry and the channel position in the magnetic field as well as on the electrical conductivity of the channel walls. Turbulent flow offers advantages over laminar flow, from the standpoint of intensifying the heat transfer, but also involves larger pressure losses. Transition to turbulent flow in a channel of rectangular cross section or in a pipe of circular cross section with smooth walls occurs at a Reynolds number of the order of $Re \geq Re_{cr}=2300$. As the magnetic field strength is increased, in terms of the Hartmann number, the critical Reynolds number also increases. In a transverse magnetic field, for instance, a change of the Hartmann number from 10 to 1000 will cause the critical Reynolds number to increase within the 6×10^3-6×10^6 range. In heat exchangers with liquid-metal coolants, therefore, laminarization of the stream is possible at high values of the Reynolds number. The pressure loss in such a mode of MHD flow is much smaller than in a turbulent mode. (16 refs.)

66645 A variational principle for surface waves in magnetohydrodynamics. B.K.Shivamoggi (The Australian Nat. Univ., Canberra, Australia).
Q. Appl. Math. (USA), vol.41, no.1, p.31-3 (April 1983).
A variational principle for the motion of the interface between an infinitely conducting fluid and a vacuum magnetic field is given. This variational principle not only gives the Laplace equation governing the velocity potential and the magnetic-field potential, but also provides all the boundary conditions appropriate to the interface between an infinitely conducting fluid and a vacuum magnetic field. However, unlike the hydrodynamical case, this variational principle does not have the simple physical interpretation of the stationarity of the fluid pressure+magnetic field pressure. (5 refs.)

66646 Flow of liquid cathodes in three-dimensional magnetic fields. A.A.Kostin, V.I.Eberil'.
Sov. Electrochem. (USA), vol.18, no.6, p.625-33 (June 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.6, p.707-15 (June 1982). [received: Feb. 1983]
Motion of a liquid cathode is examined as open-channel flow of an electrically conducting liquid without any pressure head which is brought about by the simultaneous action of body forces and electrodynamic forces that are generated in the cathode by the magnetic field of the electrolyzer and by the currents flowing in the cathode. For increasing unit power of the electrolyzers, electrodynamic forces begin to play a significant part in shaping the flowing cathode. Calculations are presented, both of the flow thickness in different sections of cathode surface (allowing for the effect of electrodynamic forces) and of the average increase in electrode gap caused by the change in cathode profile. (8 refs.)

Calculation of the characteristics of an induction-type MHD pump for $R_m s>1$ with allowance for the nonuniform distribution of the external magnetic field .. ..See Entry 64892

Equilibrium of magnetic liquids, magnetostatic application ......See Entry 66176

Heat transfer in a bounded vortex MHD-flow with volume heat release ....See Entry 66574

Interaction of a turbulent conducting vortex with a magnetic field ....See Entry 66582

Flows of magnetizable fluid with a bounded free surface ....See Entry 68810

Experimental study of the heat fluxes in a MHD channel ....See Entry 68895

47.70 REACTIVE, RADIATIVE, OR NONEQUILIBRIUM FLOWS

66647 Numerical solution of the two-dimensional equations of laminar flame propagating down a cylindrical tube. S.L.Aly (Dept. of Mech. Power, Cairo Univ., Giza, Egypt).
Appl. Math. Modelling (GB), vol.7, no.2, p.119-22 (April 1983).
A system of premixed laminar flame freely propagating, at constant pressure, down a cylindrical tube, having constant cool wall temperature, is formulated and solved numerically. Single step Arrhenius kinetics and average transport properties are used for a simulated propane-air mixture. The solution method is based on linearizing the nonlinear terms in the equations, using the Picard method, and solving line by line to cover the integration field. Iteration then proceeds with varying degrees of underrelaxation until convergence is obtained. The solution yields the flame speed and structure at any tube diameter. The flame structure reveals the wall cooling effect on the flame at various diameters. (12 refs.)

66648 Operator splitting methods for the computation of reacting flows. J.B.Greenberg (Dept. of Aeronautical Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Comput. & Fluids (GB), vol.11, no.2, p.95-105 (1983).
If the modeling of the chemistry of a reacting flow system is to consider more than a simple, one-step, global reaction the attainment of a numerical solution of the relevant governing equations is generally jeopardised by the problem of stiffness. A general approach to overcoming the stiffness hazard is presented. It makes use of operator-splitting techniques, the novel feature being that splitting of the chemical source terms themselves is permitted, with the aid of a new chemical splitting parameter. For the case of elliptic flow with a unimolecular reversible chemical reaction a convergence analysis provides an insight into the conditions under which a converged solution will be obtained. The existence of an optimum value of the chemical splitting parameter indicates the possibility of accelerating convergence. Finally, calculated results for some test problems, involving linear and nonlinear chemical kinetic models, illustrate the viability and usefulness of methods based on the new approach. (14 refs.)

Collocation simulator for a system of coupled transport operators ....See Entry 66628

Instantaneous Ramanography of a turbulent diffusion flame ... See Entry 68779

47.80 INSTRUMENTATION FOR FLUID DYNAMICS

66649 Multiprocessor computer modeling of transonic flow. A.V.Sherstyuk.
Autom. & Remote Control (USA), vol.43, no.8, pt.2, p.1099-104 (Aug. 1982). Translation of: *Avtom. & Telemekh. (USSR)*, vol.43, no.8, p.152-7 (Aug. 1982). [received: April 1983]
A problem encountered in experimental aerodynamics at transonic velocities is the elimination of the distorting influence of the walls of the wind tunnel on the gas flow in it. The methods proposed for the solution of this problem by controlling the boundary conditions at the tunnel walls entail, as an integral part of the problem, the modeling of transonic flow on a time scale consistent with the experiment. In this article the author proposes a method for the modeling of steady transonic flow, specifically tailored for implementation on a multiprocessor computer, and describes the first results of its implementation on the PS-2000 matrix-type computer system. The modeling problem applied to highly disturbed flow near an obstructing body is discussed. (9 refs.)

66650 Explosion-driven shock tubes (review). V.B.Mintsev, V.E.Fortov (Inst. of Chem. Phys., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.623-45 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.745-64 (July-Aug. 1982). [received: April 1983]
The authors examine the characteristic designs of explosion-driven shock tubes used in experimental physics, the methods for calculating their parameters, the gasdynamics possibilities for such apparatus and the methods of diagnostics, and discuss new directions in research. The schemes for linear and cumulative explosion driven tubes, explosion systems using gradient acceleration and an explosion-driven generator of rectangular pulses, and large-scale explosion installations are presented. The results of experiments are discussed on determining the radiative properties of shock waves in gases by investigating the nonideal plasma generated by the explosion, problems of high-velocity hurling, thermal working of material surfaces, and the use of explosion-driven shock tubes for transforming kinetic energy into electrical energy. (100 refs.)

66651 A sensor for flow measurements near the surface of a compressor blade. P.M.Ligrani, B.R.Gyles, K.Mathioudakis, F.A.E.Breugelmans (Von Karman Inst. for Fluid Dynamics, Rhode-St-Genese, Belgium).
J. Phys. E (GB), vol.16, no.5, p.431-7 (May 1983).
A sensor consisting of two parallel hot wires operating as a thermal tuft has been developed for flow measurements near the surface of an axial flow compressor blade rotating at 1000 rpm. Calibration characteristics of the probe, presented for different velocities, yaw angles and pitch angles, together with baseline measurements during compressor operation, show that the ratio of the effective velocities from wires indicates when the flow near a surface moves in a nominal downstream direction and when it does not. The percentage of time that the flow is well behaved, the magnitude of velocity fluctuations and autocorrelation functions are presented for different compressor operating conditions. The general utility of the sensor is demonstrated. (23 refs.)

66652 The spatial filtering effect of capacitance transducer electrodes [flow measurement]. E.A.Hammer, R.G.Green (Univ. of Manchester Inst. of Sci. & Technol., Manchester, England).
J. Phys. E (GB), vol.16, no.5, p.438-43 (May 1983).
Capacitance sensors are finding increased application in the measurement of two-component flow. An important parameter in these measurements is the frequency bandwidth of the ring and parallel plate types of sensing electrodes. In this paper the theoretical response of these electrodes to permittivity impulse signals is derived and compared with experimental data. A machine is used to drive a plastic bead through both types of electrode to obtain the impulse response for comparison with theoretical predictions. Experimental results are presented for beads travelling along the central axis of the sensor and near to its wall. For electrodes with an active length greater than 40 mm theory and experiment agree, for shorter lengths an electrode length coefficient is introduced. This gives the minimum effective length of this type of electrode as 30 mm, which is attributed to field fringing effects. (6 refs.)

66653 Couette viscometry of Casson fluids. R.W.Hanks (Dept. of Chem. Engng., Brigham Young Univ., Provo, UT, USA).
J. Rheol. (USA), vol.27, no.1, p.1-6 (Feb. 1983).
The solution of the equations of motion for a Casson model non-Newtonian fluid in a rotational Couette viscometer is presented. Proper equations for determination of rheological parameters from data obtained from commercial viscometers are derived and presented. Sample curves illustrating the influence of viscometer geometry on the rheogram are presented. (10 refs.)

66654 Turbine meters for liquid measurement. B.A.Ellison (Brooks Instrument Div., Emerson Electric Co., Statesboro, GA, USA).
Mech. Eng. (USA), vol.105, no.2, p.52-6 (Feb. 1983).
Gives a look at the effect of viscosity on turbine meter range and accuracy including types of meter outputs, principles of operation, effects of specific gravity, installation techniques, and applications. (no refs.)

66655 Viscometry of a magnetic fluid in weak fields. N.I.Ivanova, B.E.Kashevskii.
Magnetohydrodynamics (USA), vol.18, no.3, p.226-30 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.21-6 (July-Sept. 1982). [received: April 1983]
At present there are no reliable experimental data on the magnetoviscous effect in magnetic fluids in the region of weak magnetic fields, whose strength satisfies the relationship $\xi = mH/kT \leq 1$, where m is the magnetic moment of the ferroparticle, k is the Boltzmann constant, and T is the absolute temperature. The weak-field region is interesting in that it clearly reveals such important properties of the magnetic fluid as the superparamagnetism of small ferromagnetic particles (their spontaneous magnetic reversal), and also their dipole-dipole particle interaction. For instance, depending on whether the superparamagnetism is weak or pronounced, the law of increase of viscosity with field in the region $\xi \ll 1$ varies from ξ^2 to ξ^4. Reliable data in the weak-field region can be obtained by studying the behavior of resonant oscillatory systems containing magnetic fluids, in which small changes in viscosity can lead to considerable effects. (5 refs.)

66656 High viscosity (10^4-10^{11} Pa.s) measurements by the penetrometer method at low temperature (77-300K). A.Bondeau (Lab. des Dielectriques Liquides, Univ. Lyon I, Villeurbanne, France), J.Huck.
Rev. Phys. Appl. (France), vol.18, no.5, p.307-12 (May 1983). In French.
The authors have produced a cylindric penetrometer in order to measure Newtonian liquids shear viscosity between 10^4-10^{11} Pa.s and 77-300K. Measurements of the penetration depth $h(t)$ by means of an electromagnetic displacement captor are recorded on a magnetic memory and treated by a desktop computer. The variations of $h^2(t)$ are linear according to the theory. The viscosity values of phenyl salicylate measured by this penetrometer agree with the data of Laughlin and Uhlmann obtained by beam bending method. (25 refs.)

66657 Flowmeter. H.Nakane (Toshiba Corp., Kawasaki, Japan).
Refrigeration (Japan), vol.57, no.661, p.1123-36 (Nov. 1982). In Japanese.
Various types of flow transducers (meters) are commercially available. Flow transducer accuracy is affected not only by the properties of the stream, but also by the inherent characteristics of the transducer itself. The transducing principle, features, specifications, calibration and typical applications are briefly described of electromagnetic meters, ultrasonic flowmeters and venturi meters. Electromagnetic meters are now widely accepted. It is necessary that the fluid be a conductor of electricity, and this has limited their applications. One of the more interesting applications is on slurry measurements, a difficult task for most meters. Ultrasonic flowmeters are advertised as good for corrosive fluids. Venturi meters are widely used in various water and stream applications. (4 refs.) *K.B.*

66658 Measurement of the velocity of axisymmetric laminar flow by an optical visualisation technique with coherent light. C.Philippe (Lab. de Phys. & Mecanique des Fluides, Univ. de Poitiers, Poiters, France).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.137-53 (March 1983).
An optical technique, based on holography, for measuring the distribution of velocities inside a laminar flow of a transparent liquid is described. A suspension of micro-sized scattering particles in the fluid is illuminated by a coherent light sheet from a doubly pulsed ruby laser. By temporal integration on a photographic plate of the interference patterns between the two scattered fields and two successive reference fields successively, the authors get a double exposure hologram of the two successive maps of scatterer distribution. The displacement of the scatterers during the time separating the two laser pulses is measured by observation of the real holographic image through a microscope. They report experimental results about two cases of axisymmetrical flow—confined in a circular pipe, then free jet out of the pipe—for several values of the hydrodynamic parameters. (21 refs.)

66659 Instrument for measuring dynamic surface tension. A.Kukkonen, J.Nummipuro, J.Virtanen.
Report 140, Tech. Res. Centre Finland, Electr. Eng. Lab., Espoo (Jan. 1983), 32 pp.
An instrument was constructed for measuring the dynamic surface tension of water solutions by the oscillating jet method. The values of the surface tension as a function of the surface age are calculated by inserting into Bohr's equation the wave parameters, density of the liquid and flow rate of the jet. The jet is formed by hydrostatic pressure through an elliptical orifice. The cross section of the standing wave in the jet is scanned by an image sensor, from which the results are fed to a microcomputer for computing and display. The reproducibility of the measurement is better than 3% for the age range 0.8-20 ms. The practical measurements made so far support earlier research results, which suggest that the surface tension is a function of the surface age. (10 refs.)

Laser doppler measurements of flow in a rod bundle .... See Entry 65483

An optical probe for interface detection at high pressure (180 bar) and high temperature (360°C) [two-phase flow] .... See Entry 65562

Three-dimensional density field determination by external stationary detectors and gamma sources using selective scattering .... See Entry 65563

Modeling aspects of the PNA technique for flow rate measurements .... See Entry 65564

An experimental investigation of the wake of an axisymmetric body with a slanted base .... See Entry 66580

Experimental study on sluggish bubble behaviors in pressure waves .... See Entry 66612

Experimental determination of the random lump-age distribution in the boundary layer of the turbulent pipe flow using laser-Doppler anemometry .... See Entry 66630

Viscosity of some glassy minerals .... See Entry 67260

50.00 FLUIDS, PLASMAS AND ELECTRIC DISCHARGES

(for fluid dynamics, see 47.; for the physics of condensed matter, see 60. and 70.)

51.00 KINETIC AND TRANSPORT THEORY OF FLUIDS; PHYSICAL PROPERTIES OF GASES

51.10 KINETIC AND TRANSPORT THEORY

66660 The application of a modified form of the S_N method to the calculation of swarm parameters of electrons in a weakly ionised equilibrium medium. P.Segur (Centre de Phys. Atomique, Univ. Paul Sabatier, Toulouse, France), M.-C.Bordage, J.-P.Balaguer, M.Yousfi.
J. Comput. Phys. (USA), vol.50, no.1, p.116-37 (April 1983).
A numerical method is developed for the solution of the Boltzmann equation in order to calculate the swarm parameters of a weakly ionised gas. Then it is shown how these experiments can be simulated by calculation in order to explain the discrepancies observed between the parameters measured under the same conditions but in different experiments. The present method of solution which uses both Lesaint's S_N method and an iterative process based on the so-called Eddington factor. (26 refs.)

Prediction of thermodynamic properties of normal paraffins using only normal boiling point .... See Entry 67235

Theory of thermophoresis of moderately large aerosol particles .... See Entry 68813

51.20 VISCOSITY AND DIFFUSION: EXPERIMENTAL

66661 Longitudinal diffusion coefficients and test of the generalized Einstein relation for Tl^+ ions in Kr and Xe, Li^+ in Kr and Xe, and Cl^- in N_2. M.G.Thackston, M.S.Byers, F.B.Holleman, R.D.Chelf, J.R.Twist, E.W.McDaniel (School of Phys., Georgia Inst. of Technol., Atlanta, GA, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4781-2 (1 April 1983).
Since it is considerably more difficult to measure diffusion coefficients of gaseous ions than to measure their mobilities, it is convenient to have a means of calculating the former from the latter. Most methods for determining diffusion coefficients from mobilities employ empirical ad hoc correction factors; however, Waldman and Mason (1981) have derived generalized Einstein relations (GER) from the Boltzmann equation within the framework of a three-temperature kinetic theory. The authors compare longitudinal diffusion coefficient (D_L) values calculated (using the Waldman-Mason GER) from their previously reported mobility values, with experimentally measured D_L values for Tl^+ in Kr and Xe, Li^+ in Kr and Xe, and Cl^- in N_2. These measurements were made with a drift tube mass spectrometer at a gas temperature of 300K and gas pressures ranging from 0.030 to 0.400 Torr. No significant clustering of ions to the drift gas molecules was observed. (7 refs.)

51.30 THERMAL PROPERTIES OF GASES

66662 Thermodynamic functions of diatomic selenium. N.F.Vendrikh, S.I.Gorbov, A.S.Pashinkin (Moscow Inst. of Electronic Equipment, Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.921-5 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1087-92 (July 1982). [received: Feb. 1983]
Statistical thermodynamics methods have been used in performing an accurate calculation of the thermodynamic functions of selenium in the state of an ideal diatomic gas at 100-3000K. Approximation equations have been obtained for the heat capacity and enthalpy. The discrepancies between these and previous calculations have been analyzed. The new values obtained for the thermodynamic functions give the best agreement with the spectroscopic value of the dissociation energy of the Se_2 molecule. Starting with the value of $D_0(Se_2)$, by means of a calculation based on the third law of thermodynamics, a more accurate value has been obtained for the energy of excitation of the unobserved $a^1\Delta_g$ electronic state of the Se_2 molecule. (10 refs.)

66663 Composition of the gas phase in the Cd-Te-N-H-I system. Yu.G.Akhromenko, G.A.Il'chuk, S.P.Pavlishin, S.I.Petrenko (Lenin Komsomol Lvov Polytech. Inst., Lvov, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.944-8 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1117-22 (July 1982). [received: Feb. 1983]
The Cd-Te-N-H-I closed system was subjected to thermodynamic analysis, and the equilibrium partial pressures of the components of the gas phase at 700-1100K and total pressures from 1.01×10^3 to 1.01×10^5 Pa were calculated. The range of the growth of CdTe single crystals and epitaxial layers was established by the method of chemical-transport reactions by comparison of the calculated data with the Te_2 pressure above liquid tellurium and CdTe. (13 refs.)

Thermodynamic properties of a square-well fluid in the liquid and vapor regions .... See Entry 67239

Theory of thermophoresis of moderately large aerosol particles .... See Entry 68813

51.50 ELECTRICAL PHENOMENA IN GASES

(see also 52. Plasma and electric discharges)

66664 Anisotropic velocity distribution representation of the electron swarm in a weakly ionized gas. T.Makabe, T.Mori (Faculty of Engng., Keio Univ., Yokohama, Japan).
Trans. Inst. Electr. Eng. Jpn. Sect. E (Japan), vol.102, no.11-12, p.101-8 (Nov.-Dec. 1982). [received: April 1983]
Describes the anisotropic velocity distribution function of the electron swarm in weakly ionized gases from the three-term spherical harmonic expansion technique of the Boltzmann equation, and a method for solving the coupled

integro-differential equations for the electron distribution functions. In the method for solving the equations, the authors employ a numerical technique using the implicit Gear's algorithms. Important advantages of using such a numerical technique in the present system are efficiency to solve the stiff equations stably, and appropriateness for obtaining a solution of the equations with poor initial conditions. This analysis is applied to the steady-state electron swarm in helium. Comparative calculation with the conventional two-term Lorentz approximation shows that, not only at higher E/N, but even at low E/N, subject to almost spherically symmetric velocity distribution, this procedure gives the results with sufficient accuracy. Also the swarm characteristics in helium are discussed from a viewpoint of the anisotropic velocity distributions. (33 refs.)

66665 Electron thermalization in gases. B.Shizgal (Dept. of Chem., Univ. of British Columbia, Vancouver, British Columbia, Canada).
J. Chem. Phys. (USA), vol.78, no.9, p.5741-4 (1 May 1983).
The energy relaxation of energetic electrons is determined with a moment method solution of the hard sphere Lorentz-Fokker-Planck equation. The convergence of the expansion of the electron speed distribution function in speed polynomials is rapid and the energy relaxation can be written explicitly as a sum of a small number of exponential terms characterized by the lowest eigenvalues of the Lorentz-Fokker-Planck equation. The decay of the directed velocity is examined with a discrete ordinate method. The rate of convergence vs. the number of quadrature points is extremely rapid and for particular values of the initial electron energy, an exact result can be obtained. (11 refs.)

66666 Electron mobility in gases at low temperatures: the quantum mechanical Lorentz gas. I. T.R.Kirkpatrick (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), J.R.Dorfman.
J. Stat. Phys. (USA), vol.30, no.1, p.67-106 (Jan. 1983).
The zero-field mobility of electrons in dilute gases at low temperatures is studied. The authors consider the case where the de Broglie wavelength of the electron is large enough that the mobility calculation must be formulated using quantum mechanical kinetic theory. The electron mobility is then computed as a function of the gas density with the approximation that the gas is considered as a collection of fixed scatterers. They evaluate the first two terms in the density expansion of the mobility, and compare these results with experiments. (16 refs.)

66667 Influence of nonlinear frequency mixing on multiphoton ionization of gases. Yu.I.Geller, A.V.Shvabauskas.
Opt. & Spectrosc. (USA), vol.53, no.3, p.227-8 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.385-7 (Sept. 1982). [received: May 1983]
The possibility of significant increase or decrease in the probability of ionization of the medium on account of the process of nonlinear frequency mixing is shown, which is necessary to take into account in an experiment and may be used to control ionization of gases. (6 refs.)

66668 Electron diffusion and the Einstein relation in high-density gases. T.F.O'Malley (General Electric Co., San Jose, CA, USA).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.32-4 (11 April 1983).
A model which used multiple-scattering theory to derive the density dependence of thermal electron mobilities, is employed to do the same for the diffusion coefficient. A surprising consequence of this is that the thermal Einstein relation is not the simple expression that is generally written and never verified, but rather one that depends on the density. (10 refs.)

Breakdown prediction in compressed SF_6 ....See Entry 66775

R.F. plasma reactions in light hydrocarbons: effect of the input power on the decomposition of ethane ....See Entry 68774

51.60 MAGNETIC PHENOMENA IN GASES

(for liquids, see 75.)

66669 Magnetic properties of a diamagnetic gas in a resonance radiation field. B.A.Glushko, V.O.Chaltykyan (Inst. of Phys. Res., Acad. of Sci., Ashtarak, Armenian SSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1388-90 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2135-9 (Nov. 1982). [received: May 1983]
An investigation is made of the change in the magnetic properties of a diamagnetic molecule (atom) induced by a resonance optical radiation field. Calculations are made for the $0 \rightarrow 1$ molecular transition in the presence of an external magnetostatic field. Expressions are derived for the magnetization and the magnetic susceptibility of the molecule, which depend nonlinearly on the light wave intensity, in the case of longitudinal and transverse directions of the external magnetic field with respect to the direction of propagation of the radiation. It is shown that the field-induced nonlinear magnetic susceptibility of a diamagnetic substance can change sign and increase considerably (by several orders of magnitude compared with the linear diamagnetic susceptibility). The field-induced nonlinear magnetization of the substance does not depend on its magnetic properties and is the same for diamagnetic and paramagnetic substances. (8 refs.)

51.70 OPTICAL PHENOMENA IN GASES

(for liquids, see 78.)

66670 Coherent anti-Stokes Raman spectroscopy of water vapor of combustion diagnostics. R.J.Hall, J.A.Shirley (United Techols. Res. Center, East Hartford, CT, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.196-202 (March-April 1983).
The coherent anti-Stokes Raman spectroscopy spectrum of H_2O was measured in a heated optical cell and in laboratory flames. Comparisons of the experimental spectra with a theoretical model were used to infer information about the unknown Raman linewidths of H_2O. In the test cell, excellent agreement was obtained between theory and experiment in terms of physically realistic linewidths. Agreement between experiment and theory in laboratory flames was also good. (34 refs.)

66671 Detection of the Faraday rotation produced by a gas inside a Michelson interferometer. M.Pinard, L.Julien, F.Laloe (Lab. de Spectroscopie Hertzienne, ENS, Paris, France).
J. Phys. (France), vol.44, no.5, p.589-95 (May 1983).
The authors discuss a method allowing one to increase the rotation of the plane of polarization of an optical beam, produced when it crosses a circularly birefringent gas (e.g. optically pumped gas). The cell containing the gas is inserted inside one of the arms of a Michelson interferometer, the path difference being adjusted so that almost all the optical intensity is reflected backwards; if the weak beam, which is deflected at right angle by the interferometer, is detected, an enhanced rotation of the plane of polarization can be observed. After a short general discussion of this effect, they report a few experiments on optically pumped metastable Ne atoms where the effect has been seen. Enhancements of the rotation of the plane of polarization by a factor 30 have been measured. (7 refs.)

66672 Scattering of light by an intense saturating pulse in a resonance medium. V.I.Rupasov (Inst. of Spectroscopy, Acad. of Sci., Troisk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1383-7 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2127-34 (Nov. 1982). [received: May 1983]
A linear response of a resonant medium to a weak electromagnetic field is studied in the case when a medium is a gas of three-level atoms subjected to a strong saturating pulse. A noncoherent intense pulse and a coherent 2π pulse (of the kind encountered in the theory of self-induced transparency) are considered. The expressions obtained are used to study the problem of the spectrum of the reflection of light by a pulse moving in a medium. An analysis is made of the possibility of using the Doppler effect, which occurs when light is reflected by a moving pulse, in an investigation of the characteristics of pulse propagation, determination of its parameters, and study of the nonlinear characteristics of the medium itself. Possibilities of experimental observation of the predicted effects are discussed, particularly the possibility of conversion of an electromagnetic radiation spectrum. (13 refs.)

66673 Investigation of coherent emission in time-separated fields. L.S.Vasilenko, N.N.Rubtsova (Inst. of Heat Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1457-60 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2243-8 (Nov. 1982). [received: May 1983]
An investigation was made of signals of coherent radiation generated by time-separated fields in an SF_6 gas at moments $t=T+nT(n=1,2,3,4)$ under the action of two pulses of standing-wave CO_2 laser radiation. The amplitudes of such signals were investigated as a function of the detuning of the laser frequency relative to the center of the transition line of SF_6, as a function of the amplitude of the exciting radiation and also as a function of T. The rates of relaxation of the polarization, $\gamma_{12}=(46\pm5)\times10^6$ $sec^{-1}.Torr^{-1}$, and of the populations, $\gamma(42\pm4)\times10^6$ $sec^{-1}.Torr^{-1}$, were found at pressures of 1-5 (mTorr). A comparison of γ_{12} and γ gave information on the nature of collisions in the SF_6 gas. (16 refs.)

Polarization spectroscopy of gaseous media by the photon-echo method ....See Entry 64957

Integral emission and absorption characteristics of CO_2 and CO bands in conditions of vibrational disequilibrium ....See Entry 65991

Excitation of laser transitions in parametallic gas mixtures using reaction products from nuclear reactions ....See Entry 66261

Light echo in gases ....See Entry 66348

Influence of nonlinear frequency mixing on multiphoton ionization of gases ....See Entry 66667

Magnetic properties of a diamagnetic gas in a resonance radiation field ....See Entry 66669

52.00 THE PHYSICS OF PLASMAS AND ELECTRIC DISCHARGES

(for solid-state plasma, see 72.30)

52.20 ELEMENTARY PROCESSES IN PLASMA

66674 Linear theory of a cold bounded plasma. O.M.Gradov (Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR), L.Stenflo.
Phys. Rep. (Netherlands), vol.94, no.3, p.111-37 (Feb. 1983).
The linear dispersive properties of the electron surface waves of a bounded plasma are considered by means of the cold fluid theory. Wave dissipation due to resonant absorption as well as leaking processes are discussed. A general method is introduced to describe the eigenmodes of a plasma with arbitrary boundary shape. A hydrodynamic fluctuation theory, which can be useful for plasma diagnostics, is also presented. By means of the eigenmode theory the authors then discuss total absorption of plasma radiation as well as superreflectivity processes. (54 refs.)

66675 The effect of Debye screening on the ion-ion recombination rate. I.S.Lakoba, Yu.I.Syts'ko, E.D.Yakubtseva.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.22-6 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.26-31 (1982).
The known method for the calculation of the recombination coefficient for ions with opposite charges in the presence of a neutral particle, is generalized to the case when the plasma screening of their electrostatic potential becomes important. Results of the calculations are given. (2 refs.)

66676 Behaviour of population in a plasma interacting with an atomic gas. U.Furukane, T.Oda.
Report IPPJ-622, Nagoya Univ., Japan (Jan. 1983), 33 pp.
The processes leading to population inversion are investigated in a recombining hydrogen plasma which is interacting with a cool and dense neutral hydrogen gas by using the rate equations on the basis of the CR model and the energy equation for electrons, ions and neutral particles. The quasi-steady state approximation is used only for the levels higher than a certain level which is not the first excited level. The calculations show that the quasi-steady state cannot be realised while intense energy-flows due to the collisional processes exist between different kinds of the particles such as the electrons and the ions in the plasma and population inversion is realised only in the quasi-steady state following the transient phase. The effects of the initial conditions of the hydrogen plasma and the introduced neutral hydrogen gas on the over population density are also discussed. (18 refs.)

Thermal relaxation and entropy for charged particles in a heat bath with fields ....See Entry 66679

Bremsstrahlung rates in fully ionized gases in a magnetic field ....See Entry 66681

Thermal barrier on trapping rate in a tandem mirror ....See Entry 66732

Compositional characterization of microwave plasma a-Si:H films ....See Entry 68817

52.20H Atomic, molecular, heavy-particle collisions

Electron energy spectrum in low-energy collisions of negative ions and atoms ....See Entry 66120

Repopulation kinetics of intermediate levels in CO_2 laser helium grow discharge interaction ....See Entry 66708

52.25 PLASMA BASIC PROPERTIES

66677 Extended standard vector analysis with applications to plasma physics. H.K.Wimmel (Max Planck Inst. fur Plasmaphys., Garching, Munchen, Germany).
Eur. J. Phys. (GB), vol.3, no.4, p.223-9 (1982).
Standard vector analysis in three-dimensional euclidian space, as found in most tables and textbooks, is complemented by a number of basic formulae that seem to be largely unknown, but are important in themselves and for practical applications. This is demonstrated by examples from theoretical plasma physics. (22 refs.)

66678 On the thermodynamics of the two-dimensional jellium. S.Johannesen (Matematisk Inst., Univ. Oslo, Blindern, Oslo, Norway), D.Merlini.
J. Phys. A (GB), vol.16, no.7, p.1449-63 (11 May 1983).
Considers the two-dimensional classical jellium in a circular domain. Using a careful extrapolation method of the exact results for systems with a small number of particles (N=1, 2, 3, 4), the authors obtain an estimate of the free-energy density and the kinetic pressure in the thermodynamic limit for some discrete values of the plasma parameter $2\leq\gamma\leq14$. An ansatz for the free-energy density is then constructed which is in good agreement with the theoretical estimation and the numerical results of a recent Monte Carlo simulation of the system. A similar agreement is obtained for the kinetic or virial pressure. (28 refs.)

66679 Thermal relaxation and entropy for charged particles in a heat bath with fields. A.J.M.Garrett (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
J. Phys. A (GB), vol.16, no.7, p.1505-16 (11 May 1983).
The relaxation back to thermal equilibrium of one very dilute species of charged particle in a heat bath of different neutral particles, with which they collide elastically, is considered by means of the Boltzmann equation for the one-particle distribution function of the test particles. The Boltzmann collision integral is used to describe the collisions. A rigorous proof that relaxation to thermal equilibrium will always take place, even in the presence of a magnetic field, is given, initially for the case when there is no spatial dependence. The proof is based on a functional of the distribution function with properties similar to the Boltzmann entropy. This quantity is shown always to decrease until thermal equilibrium is reached, and to be bounded below by its value in thermal equilibrium. The proof is then generalised to allow for arbitrary spatial dependence of the magnetic field and the initial distribution function. (13 refs.)

Thermal instability analysis in a D-T tokamak reactor with density dynamics ....See Entry 65677

Linear theory of a cold bounded plasma ....See Entry 66674

Behaviour of population in a plasma interacting with an atomic gas ....See Entry 66676

Ion-acoustic waves infinite geometry ....See Entry 66696

The sideband instability and wave-particle interaction .... See Entry 66704

Stimulated Raman backscattering in the presence of ion-acoustic fluctuations ....See Entry 66709

Refraction and absorption in plasma atmospheres ....See Entry 66711

Quasi-linear ion heating by lower hybrid waves ....See Entry 66716

Non-Maxwellian electrons in a laser produced sodium plasma ....See Entry 66719

A pressure profile analysis of high-beta ISX-B Tokamak plasmas using MHD equilibrium geometry ....See Entry 66733

Method of Abel inversion for non-circular Tokamak geometrics ....See Entry 66743

Spectroscopic studies of the hollow cathode discharge ....See Entry 66745

Langmuir probe characteristic modulated with random fluctuations ....See Entry 66747

Limitation of the accuracy of interferometrically measured electron density profiles of laser-produced plasmas ....See Entry 66748

Measurement of small-scale density fluctuation in JIPP T-II plasma by millimeter and sub-millimeter wave scattering ....See Entry 66750

Radial density distribution of excited atoms in a surface-wave-produced Ar-O_2 plasma column ....See Entry 66751

Measurement of plasma conductivity using Faraday rotation of submillimeter waves ....See Entry 66752

Characteristics of a discharge in a He-CO_2-Cs mixture and their effects on the rate of chemical combination of cesium ....See Entry 66767

Ionospheric plasma cloud dynamics via regularized contour dynamics. I. Stability and nonlinear evolution of one-contour models ....See Entry 69412

Charge neutrality and plasma distribution function in a dipole magnetic field ....See Entry 69436

52.25F Transport properties

66680 A scaling law for the anomalous electron transport in Tokamaks. Zhang Yang-Zhung (Southwestern Inst. of Phys., Leshan, Sichuan, China).
Acta Phys. Sin. (China), vol.32, no.2, p.191-7 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
It is assumed that the dominant mechanism for the anomalous electron transport in Tokamaks is the renormalized electron magnetic drift wave driven by temperature gradient. A scaling law for the anomalous electron transport coefficient $D^{(T)}$ has been derived by solving self-consistently the kinetic process, it reads $D^{(T)}=(c/\omega_{pc})^2\{\sqrt{(\nu_e/qR)^2/2\pi+(\nu_c/2)^2}-\nu_c/2\}$. It coincides in numerical values with the Alcator scaling law given by the Tokamak's experiments, and it agrees with the ohkawa scaling law in the collisionless limit ($\nu_c\rightarrow0$). Furthermore, its deviation from the Alcator scaling law is analyzed, and the possibility of achieving the thermonuclear ignition for a high-field ohmically heating Tokamak is also discussed based on the scaling law. (20 refs.)

66681 Bremsstrahlung rates in fully ionized gases in a magnetic field. S.Imazu, J.Irisawa, S.Takano (Dept. of Electrical Engng., Technol. Univ. of Nagaoka, Nagaoka, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1224-9 (April 1983).
The bremsstrahlung rates in fully ionized gases in a magnetic field are theoretically investigated. Here it is assumed that the charged particles have Maxwell velocity distributions, and that an external electric field does not exist. In the theoretical treatment, the following points are considered: when the Larmor radius is larger than the radius of the collisional cross section due to the bremsstrahlung, the radiation of energy during a short time at an instant of the collision is not affected by the magnetic field. However, according to the gyration, the relative velocity between an electron and a colliding ion during the free path is affected by the magnetic field strength. Numerical calculations show that the bremsstrahlung rate in the presence of the magnetic field is smaller than that in the absence of the magnetic field. (9 refs.)

66682 Radial motion of a field-reversed ion layer. A.Ishida, K.Kitao (Dept. of Phys., Niigata Univ., Niigata, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1251-4 (April 1983).
Radial motion of a field-reversed ion layer is investigated theoretically in the limit of an extremely field-reversed thin layer. It is assumed that the ion layer consists of a fluid of rigidly rotating ions with finite temperature and a fluid of cold stationary electrons. The ion layer radially vibrates as a whole with a frequency nearly equal to the betatron frequency of a single ion.

66683 Spatial diffusion of charged high-energy fusion products by shear Alfven perturbations. F.Pegoraro, L.Sugiyama (MIT, Cambridge, MA, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.407-23 (April 1983).
The interaction between shear Alfven perturbations and the charged high-energy particles produced by fusion reactions is investigated. The aim is to evaluate the conditions that must be realized in order for the quasilinear diffusion flux of the fusion products to become significant. It is found that in the most relevant cases a severe deterioration in the confinement properties of the fusion products is not to be expected. This result follows from taking explicitly into account the spectral properties of shear Alfven perturbations in a toroidal configuration with magnetic shear. (28 refs.)

66684 Alpha particle loss and energy deposition in tandem mirrors. J.F.Santarius, J.D.Callen (Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
Phys. Fluids (USA), vol.26, no.4, p.1037-43 (April 1983).
The bounce averaged Fokker-Planck equation is solved for alpha particles slowing down in a background plasma of electrons and ions in the central cell of a tandem mirror. The problem is formulated for a general, monotonic magnetic field, and then solved numerically for the square-well case. This gives a distribution function in energy and lambda (magnetic moment/energy). The resulting loss of alpha particles by scattering into the magnetic loss cone and the distribution of alpha-particle energy to ions and electrons are given. For typical tandem mirror reactor parameters ($T_e\sim30$ keV, $\phi\sim100$ keV, $R\sim4$) about half of the alpha particles are born in or scatter into the loss cones, but less than 25% of the total alpha particles' energy is lost through these mechanisms. (14 refs.)

66685 Spectroscopic determination of the viscosity of a fully ionized plasma by means of the dynamics of acceleration by a traveling wave. M.von Hellermann, C.Piffko, A.Stampa (Fachbereich Phys., Univ. Essen-GHS, Essen, Germany).
Phys. Fluids (USA), vol.26, no.4, p.1054-60 (April 1983).
The mechanism of plasma acceleration by a traveling wave is derived from a cold plasma magnetohydrodynamic model with finite conductivity and finite Hall parameter. It is shown that collective effects may strongly influence the dynamics of the acceleration process. Eigenmodes of the plasma column considerably improve the acceleration whereas in general, plasma turbulence, induced by the primary wave, will reduce the efficiency of the process. Both mechanisms are demonstrated in an experiment where a high-amplitude traveling-wave pulse accelerates a nearly fully ionized plasma. In this experiment the flow profile is determined by the balance of electromagnetic and viscous forces. This enables one to determine the viscosity spectroscopically by measuring the flow velocity of the plasma. The experimental value of the viscosity is in accordance with the Spitzer formula. (8 refs.)

66686 Studies of radio frequency current drive in a plasma. D.K.Bhadra, C.Chu, R.W.Harvey, R.Prater (General Atomic Co., San Diego, CA, USA).
Plasma Phys. (GB), vol.25, no.4, p.361-85 (April 1983).
The physics of radio-frequency current drive for steady-state Tokamak operation has been studied in the context of a conceptual small Tokamak, called the RST. Two distinctively different schemes of current drive by using RF waves have been discussed. In the first, a wave travelling in the toroidal direction damps on the electrons, thereby transferring momentum to the electrons, creating a current; typical of this category is Landau damping of traveling lower hybrid waves. The second general category is called 'enhanced bootstrap' current, in which RF waves may be used to enhance the cross-field particle diffusion above the neoclassical rate, thereby producing significant enhancement of the plasma bootstrap current at reduced plasma pressure. (29 refs.)

66687 The effect of localised wave power absorption on ECRH driven currents in a Tokamak. D.F.H.Start, J.G.Cordey, T.Edlington (Culham Lab., Abingdon, England).
Plasma Phys. (GB), vol.25, no.4, p.447-53 (April 1983).
The current driven by electron cyclotron resonance heating in a Tokamak is shown to depend strongly on the poloidal angle at which the power is absorbed. This dependence arises because the ratio of passing to trapped electrons varies around each flux surface. A Fokker-Planck treatment is used to obtain the current as a function of poloidal angle, wave phase velocity and inverse aspect ratio. The effect offers the possibility of experimentally demonstrating the existence of trapped electrons in a Tokamak. (8 refs.)

Scaling of critical beta in a Tokamak ....See Entry 65675

Thermal instability analysis in a D-T tokamak reactor with density dynamics ....See Entry 65677

Drift-resistive interchange and tearing modes in cylindrical geometry ....See Entry 66698

Some physical problems of RF heated Tokamak plasma in a hybrid reactor regime ....See Entry 66723

Neoclassical theory of alpha-particle transport in the central region of a Tokamak plasma ....See Entry 66731

Parametric systems analysis of the modular stellarator reactor ....See Entry 66734

Improved theory of collisionless particle motion in stellarators ....See Entry 66738

Effects of ambipolar potential on multiple mirror confinement ....See Entry 66739

Symmetry of the complete second-order nonlinear conductivity tensor for an unmagnetized relativistic turbulent plasma .... See Entry 66744

Damping of the plasma resonance of a probe in a drifting Maxwellian plasma .... See Entry 66746

Measurement of plasma conductivity using Faraday rotation of submillimeter waves .... See Entry 66752

Charge neutrality and plasma distribution function in a dipole magnetic field .... See Entry 69436

52.25P Emission, absorption, and scattering of radiation

66688 Electromagnetic radiation from beam-plasma instabilities. P.L.Pritchett, J.M.Dawson (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).

Phys. Fluids (USA), vol.26, no.4, p.1114-22 (April 1983).

The generation of electromagnetic radiation from the unstable electrostatic waves of a beam-plasma system is investigated by means of computer simulation. A two-dimensional model is employed in which the plasma is treated as a finite system and in which the effects of a continuous beam inflow are included. For the parameters of the simulation ($n_b/n_0 \sim 1\%$, an essentially nonrelativistic beam, and no external magnetic field), the radiation is concentrated near the plasma frequency, is emitted preferentially perpendicular to the beam, and is polarized with **E** parallel to the beam direction. Radiation at the second harmonic is found to be weak. The production mechanism is found to be the scattering of Langmuir waves from ion-acoustic fluctuations, and the observed radiation level agrees well with the theoretical predictions for such a three-wave coupling. The results of the numerical experiments are compared with the recent laboratory experiment of Whelan and Stenzel (Phys. Rev. Lett. vol.47, no.2, p.95, 1981). (22 refs.)

Metal plasma induced by the bombardment of 308 nm excimer and 585 nm dye laser pulses at low pressure .... See Entry 66721

Laser-plasma-induced extreme-ultraviolet radiation from liquid mercury .... See Entry 66722

Absorption of intense gaussian electromagnetic radiation in a magnetoplasma via inverse bremsstrahlung .... See Entry 66755

52.30 PLASMA FLOW; MAGNETOHYDRODYNAMICS

(see also 47.65 Fluid dynamics)

66689 Resistive force acting on a microscopic particle in a low-temperature plasma jet. A.A.Uglov, A.G.Gnedovets, Yu.N.Lokhov (A.A. Baikov Metall. Inst., Acad. of Sci., USSR).

High Temp. (USA), vol.20, no.4, p.512-17 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.621-6 (July-Aug. 1982). [received: April 1983]

Properties of charge exchange between a microscopic particle and a rarefied flow of low-temperature plasma are considered. If the microscopic particle is small and charged ($R < r_D$), interaction of plasma ions with the microscopic particle contributed greatly to the resistance. (18 refs.)

66690 Magnetohydrodynamics of average fields in an inhomogeneous turbulent medium. L.L.Kichatinov.

Magnetohydrodynamics (USA), vol.18, no.3, p.266-72 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.67-73 (July-Sept. 1982). [received: April 1983]

MHD turbulence is characteristic of plasma in many cases. All physical quantities characterizing the plasma contain random fine-scale pulsations against the background of relatively large-scale components. Turbulence in many ways determines the dynamics of average fields. The phenomena of turbulent diffusion and viscosity, a diamagnetism of turbulent plasma, and other effects important for applications are well known. The author examines the dynamics of a large-scale magnetic field and a velocity field, i.e. magnetic hydrodynamics of average fields, in the presence of turbulence. (10 refs.)

66691 Expansion of a multi-ion plasma into a vacuum. Nagendra Singh, R.W.Schunk (Center for Atmospheric & Space Sci., Utah State Univ., Logan, UT, USA).

Phys. Fluids (USA), vol.26, no.4, p.1123-8 (April 1983).

Numerical solutions of the Vlasov and Poisson equations for the expansion of a plasma with O^+ and H^+ as the constituent ions are presented. The self-similar nature of the expansion is examined by comparing the numerical results with available theories. The formation of a plateau in the expansion region, when the H^+ ions are initially minor, is investigated by varying the electron to ion temperature ratio. The numerical results show that self-similarity holds in the quasineutral regions of the plasma. (10 refs.)

66692 Observations of plasma rotation in the high beta Tokamak Torus II. C.A.Kostek, T.C.Marshall (Dept. of Appl. Phys. & Nuclear Engng., Columbia Univ., New York, NY, USA).

Plasma Phys. (GB), vol.25, no.4, p.421-33 (April 1983).

Toroidal and poloidal plasma rotation are measured in a high beta Tokamak device by studying the Doppler shift of the 4686 Å He II line. The toroidal flow motion is in the same direction as the plasma current at an average velocity of 1.6×10^6 cm s^{-1}, a small fraction of the ion thermal speed. The poloidal flow follows the ion diamagnetic direction, also at an average speed of 1.6×10^6 cm^{-1}. In view of certain ordering parameters, the toroidal flow is compared with the predictions of neoclassical transport theory in the collisional regime. For the poloidal motion, however, it is likely that an $(\mathbf{E}_r \times \mathbf{B})/B^2$ drift in a positive radial electric field, approaching a stable ambipolar state (Stringer, 1970) is responsible. Mechanisms for the time evolution of the rotation are also examined. The radial electric field responsible for the $(\mathbf{E}_r \times \mathbf{B})/B^2$ drift is determined from the theory using the measured poloidal velocity. (25 refs.)

Spatial diffusion of charged high-energy fusion products by shear Alfven perturbations .... See Entry 66683

Spectroscopic determination of the viscosity of a fully ionized plasma by means of the dynamics of acceleration by a traveling wave .... See Entry 66685

Behavior of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. I. Experiment .... See Entry 66727

Behaviour of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. II. Theory .... See Entry 66728

A pressure profile analysis of high-beta ISX-B Tokamak plasmas using MHD equilibrium geometry .... See Entry 66733

Dissipation of MHD waves in an inhomogeneous streaming plasma .... See Entry 69481

Nonlinear Rayleigh-Taylor instability .... See Entry 69482

52.35 WAVES, OSCILLATIONS, AND INSTABILITIES IN PLASMA

66693 The nongeometrical optic solution for the Alfven wave in double plasma beam model. Shi Chang-he (Dept. of Geophys., Peking Univ., Peking, China).

Acta Phys. Sin. (China), vol.32, no.1, p.25-32 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*

The author used the smooth perturbation method to treat the problem of Alfven wave propagation in double plasma system. The wave propagation is analysed for two cases. One is that when the dense homogeneous beam moves in an inhomogeneous background plasma and the other one is the opposite situation. (8 refs.)

66694 Parametric stabilisation of fire-hose instability in a plasma. B.K.Shivamoggi (Dept. of Theoretical Phys., Australian Nat. Univ., Canberra, Australia).

Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.443-6 (1983).

Parametric stabilisation of a fire-hose instability in an anisotropic plasma with regard to an Alfven wave by means of a temporally-modulating magnetic field is discussed. (8 refs.)

66695 Drift waves in a straight stellarator. A.Bhattacharjee, J.E.Sedlak, P.L.Similon, M.N.Rosenbluth, D.W.Ross (Inst. for Fusion Studies, Univ. of Texas, Austin, TX, USA).

Phys. Fluids (USA), vol.26, no.4, p.880-2 (April 1983).

The eigenmode structure of drift waves in a straight stellarator is investigated using the ballooning mode formalism. The electrons are assumed to be adiabatic and the ions constitute a cold, magnetized fluid. The 'effective potential' has an overall parabolic envelope but is modulated strongly by helical ripples along **B**. Two classes of solutions are found: those that are strongly localized in local helical wells, and those that are weakly localized and have broad spatial extent. The weakly localized modes decay spatially due to the existence of Mathieu resonances between the periods of the eigenfunction and the modulation of the 'effective potential'. (6 refs.)

66696 Ion-acoustic waves infinite geometry. R.V.Jensen, I.B.Bernstein (Mason Lab., Yale Univ., New Haven, CT, USA).

Phys. Fluids (USA), vol.26, no.4, p.953-8 (April 1983).

The effects of finite geometry on the frequency spectrum and mode structure of ion-acoustic oscillations in an equilibrium ($T_e = T_i$) plasma are investigated. Numerical and analytical results for one-dimensional models of collisional plasmas with both absorbing and reflecting boundaries show that these modes are strongly damped. With absorbing boundaries the fluctuations are damped in an ion-transit time. For reflecting boundaries the frequency spectrum is identical to the heavily Landau-damped spectrum for an unbounded plasma. These theoretical calculations suggest that the weakly damped, low-frequency density fluctuations recently observed in incandescent cavities are not ion-acoustic waves. (14 refs.)

66697 Electromagnetic instability of Langmuir waves in a magnetoplasma. P.K.Shukla, M.Y.Yu (Inst. fur Theoretische Phys., Ruhr-Univ. Bochum, Bochum, Germany).

Phys. Fluids (USA), vol.26, no.4, p.959-61 (April 1983).

The stability of a finite amplitude electron plasma wave with respect to Alfven wave perturbations is considered. Three-wave decay as well as modulational instabilities are investigated. Analytical expressions for the growth rates are obtained. (11 refs.)

66698 Drift-resistive interchange and tearing modes in cylindrical geometry. J.M.Finn, W.M.Manheimer (Naval Res. Lab., Washington, DC, USA).

Phys. Fluids (USA), vol.26, no.4, p.962-73 (April 1983).

Resistive interchange and tearing modes are studied including the effects of electron parallel pressure gradient and ion polarization drift (Hall terms) as well as finite plasma compressibility and perpendicular resistivity. It is found that for unfavorable curvature and weak tearing forces (positive but small Δ') all modes are stabilized provided the effects of the Hall (drift) terms are large enough. The principal stabilizing influences are plasma compression and coupling to outgoing drift waves. The relevance to reversed field pinch and spheromak experiments is discussed. (31 refs.)

66699 The whistler instability at relativistic energies. N.T.Gladd (JAYCOR, San Diego, CA, USA).

Phys. Fluids (USA), vol.26, no.4, p.974-82 (April 1983).

The effects of a relativistic electron population on the temporal and spatial growth rates of the whistler instability are considered. It is found that relativistic effects tend to reduce the temporal growth rate of the whistler but are not sufficient, by themselves, to completely stabilize the mode. Relativistic effects are also found to reduce the volume of parameter space over which temporal growth can occur; the residual rate of spatial growth, however, is substantial. The results obtained are applied to two plasmas with significant relativistic electron content—the ELMO Bumpy Torus and the Tandem Mirror Experiments. (22 refs.)

66700 Solitary drift waves in the presence of magnetic shear. J.D.Meiss, W.Horton (Inst. for Fusion Studies, Univ. of Texas, Austin, TX, USA).

Phys. Fluids (USA), vol.26, no.4, p.990-7 (April 1983).

The two-component fluid equations describing electron-drift and ion-acoustic waves in a nonuniform magnetized plasma are shown to possess nonlinear two-dimensional solitary wave solutions. In the presence of magnetic shear, radiative shear damping is exponentially small in L_s/L_n for solitary drift waves, in contrast to linear waves. (15 refs.)

66701 Experimental study of the dissipative trapped ion instability. G.A.Navratil, A.K.Sen, J.Slough (Plasma Phys. Lab., Columbia Univ., New York, NY, USA).

Phys. Fluids (USA), vol.26, no.4, p.1044-53 (April 1983).

A new, steady-state linear machine has been constructed which produces a low-density, low-temperature hydrogen plasma in the collisionality regime of the dissipative trapped ion instability. This instability was seen and identified through the observed dependence of the wave amplitude on trapped fraction, axial and radial position, and collisionality and through the scaling of the real frequency with trapped fraction. The observed radial and axial mode structure of the instability is compared with the results of a simple radial model and a calculation of the Landau damping for both trapped and transit particles in a linear geometry. (13 refs.)

66702 Linear oscillations in general magnetically confined plasmas. Liu Chen (Plasma Phys. Lab., Princeton Univ., Princeton, NJ, USA), Shih-Tung Tsai.
Plasma Phys. (GB), vol.25, no.4, p.349-59 (April 1983).
A systematic formalism for investigating linear electromagnetic perturbations in general magnetic field configurations is developed. The formalism employs the small adiabaticity parameter ρ/L_0 and is valid for arbitrary frequencies. Here, ρ and L_0 are, respectively, the Larmor radius and equilibrium scale length. Effects associated with plasma and magnetic field inhomogeneities as well as finite Larmor radii are contained. The specific case of axisymmetric Tokamaks is then considered to illustrate the potential application. (18 refs.)

66703 Dispersive effects for Alfven surface waves. I.C.Rae (Res. Group, British Aerospace Dynamics Group plc, Hatfield, England).
Plasma Phys. (GB), vol.25, no.4, p.455-8 (April 1983).
Non-dispersive Alfven surface waves at a plasma interface became dispersive when non-uniformities in the equilibrium are introduced. (10 refs.)

66704 The sideband instability and wave-particle interaction. B.P.Koch, R.W.Leven (Sektion Phys./Elektronik, Ernst-Moritz-Arndt-Univ. Greifswald, Greifswald, Germany).
Phys. Scr. (Sweden), vol.27, no.3, p.220-4 (March 1983).
The sideband instability of a large amplitude electron plasma wave is studied by the numerical solution of the Vlasov equation. To give the contribution of the wave-particle mechanism exactly the quasilinear equations are solved simultaneously. As a result the wave-particle mechanism is to some extent responsible for the instability of the lower sideband. To explain the instability of the upper sideband, mode coupling must be included. (18 refs.)

66705 Angular distribution of ion-acoustic turbulence in a magnetized plasma with current. G.M.Batanov, A.E.Petrov, A.V.Sapozhnikov, K.A.Sarksyan, N.N.Skvortsova.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.27-32 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.32-7 (1982).
Presents the results of an experimental investigation of the ion acoustic turbulence in a magnetoactive plasma excited by a drift current. The spectrum of the ion-acoustic turbulence is found to be anisotropic with a maximum, directed perpendicular to the current. (10 refs.)

Nonlinear electron Landau damping of ion-acoustic solitons ... See Entry 64701

Scaling of critical beta in a Tokamak .... See Entry 65675

Thermal instability analysis in a D-T tokamak reactor with density dynamics . ... See Entry 65677

Interaction of a helical nonsymmetric wave with a fast cyclotron wave in an electron beam .... See Entry 66191

Plamsa oscillations in an ion argon laser .... See Entry 66255

Linear theory of a cold bounded plasma .... See Entry 66674

A scaling law for the anomalous electron transport in Tokamaks .... See Entry 66680

Spatial diffusion of charged high-energy fusion products by shear Alfven perturbations .... See Entry 66683

Spectroscopic determination of the viscosity of a fully ionized plasma by means of the dynamics of acceleration by a traveling wave .... See Entry 66685

Electromagnetic radiation from beam-plasma instabilities .... See Entry 66688

Steady-state turbulence with a narrow inertial range .... See Entry 66706

Structure of an excited weakly ionized plasma with a discontinuously moving neutral component .... See Entry 66707

Stimulated Raman backscattering in the presence of ion-acoustic fluctuations .. .. See Entry 66709

Stimulated Brillouin scattering in an inhomogeneous plasma with broad-bandwidth thermal noise .... See Entry 66710

Quasi-linear ion heating by lower hybrid waves .... See Entry 66716

Lower hybrid additional heating for toroidal plasmas .... See Entry 66718

Some physical problems of RF heated Tokamak plasma in a hybrid reactor regime .... See Entry 66723

Parametric systems analysis of the modular stellarator reactor .... See Entry 66734

Macroscopic plasma behavior in a high-voltage toroidal theta pinch .... See Entry 66741

The oscillation of the trapped flux in the early phase of a reversed field θ-pinch .... See Entry 66749

Measurement of small-scale density fluctuation in JIPP T-II plasma by millimeter and sub-millimeter wave scattering .... See Entry 66750

Ionospheric plasma cloud dynamics via regularized contour dynamics. I. Stability and nonlinear evolution of one-contour models .... See Entry 69412

Lower hybrid drift instability with temperature gradient in a perpendicular shock wave .... See Entry 69437

Stability of electron distributions within the Earth's bow shock .... See Entry 69438

Dissipation of MHD waves in an inhomogeneous streaming plasma .... See Entry 69481

Nonlinear Rayleigh-Taylor instability .... See Entry 69482

52.35R Plasma turbulence

66706 Steady-state turbulence with a narrow inertial range. J.C.Weatherall, D.R.Nicholson, M.V.Goldman (Dept. of Astro-Geophys., Univ. of Colorado, Boulder, CO, USA).
Phys. Fluids (USA), vol.26, no.4, p.1103-13 (April 1983).
Coupled two-dimensional wave equations are solved on a computer to model Langmuir wave turbulence excited by a weak electron beam. The model includes wave growth due to beam-plasma interaction, and dissipation by Landau damping. The inertial range is limited to a relatively small number of modes such as could occur when the ratio of masses between the negative and positive ions is larger than in a hydrogen plasma, or when there is damping in long wavelength Langmuir waves. A steady state is found consisting of quasistable, collapsed wave packets. The effects of different beam parameters and the assumed narrow inertial range are considered. The results may be relevant to plasma turbulence observed in connection with type III solar bursts. (40 refs.)

Magnetohydrodynamics of average fields in an inhomogeneous turbulent medium .... See Entry 66690

Angular distribution of ion-acoustic turbulence in a magnetized plasma with current .... See Entry 66705

Symmetry of the complete second-order nonlinear conductivity tensor for an unmagnetized relativistic turbulent plasma .... See Entry 66744

Measurement of small-scale density fluctuation in JIPP T-II plasma by millimeter and sub-millimeter wave scattering .... See Entry 66750

52.35T Shock waves

66707 Structure of an excited weakly ionized plasma with a discontinuously moving neutral component. A.A.Rukhadze, S.F.Teselkin (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1311-13 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2129-33 (Nov. 1982). [received: May 1983]
The structure of plane ion-sound waves of finite amplitude maintained in a weakly ionized plasma by a shock wave in the neutral component is studied theoretically. The two cases of a nonisothermal gas plasma by $T_e \gg T_i \gtrsim T_n$ and a plasma in solids with a degenerate electron component are considered. It is shown that forced interaction of neutral particles with the charged component results in ion-neutral friction and produces an excitation in the charged plasma component similar to a shock wave, with leading edge width much greater than the free path lengths of the ions and neutral particles. (7 refs.)

Metal plasma induced by the bombardment of 308 nm excimer and 585 nm dye laser pulses at low pressure .... See Entry 66721

Lower hybrid drift instability with temperature gradient in a perpendicular shock wave .... See Entry 69437

Stability of electron distributions within the Earth's bow shock .... See Entry 69438

52.40 PLASMA INTERACTIONS

52.40D Electromagnetic wave propagation in plasma

66708 Repopulation kinetics of intermediate levels in CO_2 laser helium grow discharge interaction. G.Gousset, P.Pignolet, B.Dubreuil (CNRS, Univ. d'Orleans, Orleans, France).
J. Phys. B (GB), vol.16, no.9, p.L299-304 (14 May 1983).
A time-resolved spectroscopic study of the perturbation of a capillary glow discharge in helium by radiation from a TEA CO_2 laser ($I_L = 6$ MW cm^{-2}) is reported. The one- and two-photon ionisation processes induced a lowering of the $p \geq 8$ excited-state population. However, due to collisional and radiative processes the states $p \leq 7$ which do not undergo photoionisation are also strongly depopulated. From a comparison of a kinetic model with experiment, total recombination and quenching coefficients for $p \leq 7$ levels are obtained. (11 refs.)

66709 Stimulated Raman backscattering in the presence of ion-acoustic fluctuations. W.Rozmus, A.A.Offenberger, R.Fedosejevs (Dept. of Electrical Engng., Univ. of Alberta, Edmonton, Alberta, Canada).
Phys. Fluids (USA), vol.26, no.4, p.1071-8 (April 1983).
Threshold conditions are analyzed for stimulated Raman backscattering (SRS) from an underdense plasma in the presence of ion-acoustic fluctuations. For typical ion-acoustic spectra which could result from a Brillouin instability occurring simultaneously with SRS, a reduced collisional threshold due to induced bremsstrahlung is found for the Raman instability. Similarly, for inhomogeneous plasma the phase mismatch created by a density gradient can be compensated for by an inhomogeneity in the ion-acoustic spectrum; as a consequence, the inhomogeneity threshold for absolute instability can be substantially reduced. Comparisons are made with experimental observations of stimulated Raman scattering in the presence of strong stimulated Brillouin scattering for CO_2 laser-plasma interaction. It is found theoretically that for fluctuation levels typical of that accompanying SBS, induced bremsstrahlung growth rates for Langmuir waves can be of the order of collisional damping rates. (23 refs.)

66710 Stimulated Brillouin scattering in an inhomogeneous plasma with broad-bandwidth thermal noise. A.Ramani (Centre de Phys. Theorique, Ecole Polytech., Palaiseau, France), C.E.Max.
Phys. Fluids (USA), vol.26, no.4, p.1079-102 (April 1983).
Stimulated Brillouin scattering in a plasma containing broad-bandwidth thermal noise was considered. Plasma profiles which are inhomogeneous (for example, because of a velocity gradient) were studied. At each point in the profile, a different electromagnetic wave can be resonant with the pump wave and a local ion acoustic wave, and can thus be amplified from its noise level. Some difficult points of the linear theory of this process are first examined. Then a nonlinear equation is derived, which governs the decrease of the incident-wave amplitude as it propagates toward the critical density surface. Solutions of this equation predict a maximum value of the absorbed intensity, I_{max}. For incident laser intensities I_{in}, higher than this value, only a fraction I_{max}/I_{in} is absorbed. (22 refs.)

66711 Refraction and absorption in plasma atmospheres. G.J.Pert (Dept. of Appl. Phys., Univ. of Hull, Hull, England).
Plasma Phys. (GB), vol.25, no.4, p.387-419 (April 1983).
Within the geometrical optics approximation the path of a ray in a plasma atmosphere is identical to the motion of a single particle under a potential of the same spatial variation as the electron density. The analogy may be used to construct the ray trajectories. In particular a set of analytic solutions for spherical atmospheres with inverse power law density fall off may be constructed. The absorption due to linear processes, collisional and resonant, is then evaluated. The application of these solutions to cylindrical and planar atmospheres is demonstrated. The extension to more general density distribution is outlined. (9 refs.)

66712 Propagation of a Gaussian beam in a nonhomogeneous plasma. A.L.Gutman.
Radio Eng. & Electron. Phys. (USA), vol.27, no.6, p.16-25 (June 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.6, p.1073-82 (June 1982). [received: May 1983]
The method of standard equations is used to obtain a linearly approximate solution to the problem of propagation of a Gaussian beam in a smoothly nonhomogeneous, plane-stratified medium which contains a region where the dielectric permittivity changes from positive to negative values. Asymptotic behaviour of incident, reflected and transmitted beams is discussed and the conditions of preservation of characteristic structure are derived. (5 refs.)

Interaction of a helical nonsymmetric wave with a fast cyclotron wave in an electron beam .... See Entry 66191

Electromagnetic radiation from beam-plasma instabilities .... See Entry 66688

Geometry effects on ion heating at ion cyclotron frequencies .. See Entry 66717

52.40F Antennas in plasma; plasma-filled wave guides

Damping of the plasma resonance of a probe in a drifting Maxwellian plasma ....See Entry 66746

52.40H Solid-plasma interactions

Edge-plasma properties of the UCLA Tokamaks .... See Entry 66753

52.40M Beam interactions in plasma

66713 Magnetic guiding, focusing and compression of an intense charge-neutral ion beam. S.Robertson (Phys. Dept., Univ. of California, Irvine, CA, USA).
Phys. Fluids (USA), vol.26, no.4, p.1129-38 (April 1983).
The motion of an intense, charge- and current-neutralized ion beam propagating axially into a solenoidal magnetic field in vacuum is shown to be described by one of two models depending on whether or not the beam magnetic skin depth c/ω_{pe} exceeds half the beam radius. For a less-intense beam having a large skin depth, a new theoretical model is presented which shows that a solenoidal field penetrates to the beam axis and acts as a lens. If a minimum beam density is exceeded, the electrons and ions are brought to a common focus as a result of quasineutrality. The collective focal length is the geometric mean of the focal lengths for the two species when traveling alone. For an intense beam having a small skin depth, the applied field is excluded from the center of the beam channel by a skin current and the resulting magnetic pressure gradient compresses the beam. This case is similar to the theta pinch and is described by a snowplow model.The two models are verified by experiments with a 150 kV, 0.5-5 A/cm^2 proton beam from a magnetically insulated diode. Possible applications in magnetic fusion, inertial fusion, and magnetospheric physics are discussed. (36 refs.)

Electromagnetic radiation from beam-plasma instabilities ....See Entry 66688

Angular distribution of ion-acoustic turbulence in a magnetized plasma with current ....See Entry 66705

Steady-state turbulence with a narrow inertial range .... See Entry 66706

52.50 PLASMA PRODUCTION AND HEATING

66714 Fast-ion behaviour for quasi-perpendicular high-energy neutral injection into the TFR 600 Tokamak.
Nucl. Fusion (Austria), vol.23, no.4, p.425-32 (April 1983).
A systematic comparison of charge exchange and neutron flux measurements with a Monte Carlo simulation code solving the full Fokker-Planck equation has shown that the fast-ion behaviour in TFR 600, with quasiperpendicular injection, can be explained classically. This important conclusion permits the beam energy deposition and the energy given to the plasma electrons and ions to be calculated so that the energy balance of the plasma can be obtained. (21 refs.)

66715 Current driven by a asymmetrical minority heating in ICRF. S.C.Chiu, V.S.Chan, J.Y.Hsu, G.E.Guest, R.Prater, J.M.Rawls (General Atomic Co., San Diego, CA, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.499-511 (April 1983).
Current generation by asymmetric heating of a minority ion species in the ion cyclotron range frequencies is calculated in the weak RF limit in toroidal geometry. Both trapped ions and trapped electrons produce significant modifications to the current generated. Depending on the ratio of the charge of minority to majority species, the current generated can be either sharply peaked at the centre or flattened towards the outside. (22 refs.)

66716 Quasi-linear ion heating by lower hybrid waves. M.Brambilla, Yan-ping Chen (Max-Planck-Inst. fur Plasmaphys., Garching, Germany).
Nucl. Fusion (Austria), vol.23, no.4, p.541-5 (April 1983).
The authors have investigated quasi-linear ion Landau damping of lower hybrid waves in an inhomogeneous plasma. To this end, they have simultaneously solved Maxwell equations and the ion kinetic equation, starting from the antenna and proceeding towards the centre of a plane-layered plasma. As a consequence of the development of a supra-thermal tail in the ion distribution function, the efficiency of the absorption increases and the asorption region is found to shift to lower densities as the launched power increases. Absorption is always complete at the layer where the wave phase velocity equals about three times the local ion thermal velocity usually somewhat before the linear turning point is reached. (19 refs.)

66717 Geometry effects on ion heating at ion cyclotron frequencies. H.Weitzner (Courant Inst. of Math. Sci., New York Univ., New York, NY, USA).
Phys. Fluids (USA), vol.26, no.4, p.998-1007 (April 1983).
The interaction of ions with electromagnetic waves at frequencies on the order of the ion cyclotron frequency is studied without the assumption of geometrical optics. Instead, it is assumed that the time for an ion to travel one wavelength is large compared with the wave period. Such a scaling admits nontrivial effects of the plasma geometry and is particularly appropriate to the ELMO Bumpy Torus experiment. The relevant frequency range is from one to a moderate multiple of the ion cyclotron frequency. It is shown that the ion response may be represented by the usual cold ion conductivity and with appropriate jump conditions across the fundamental resonant surface. Nonresonant energy transfer is calculated and shown to exist under many circumstances, depending on the antenna and electron response. Expressions are given for the resonant energy absorption at the fundamental and second harmonic. At higher harmonics, the nonresonant energy transfer is large compared with the resonant absorption. (3 refs.)

66718 Lower hybrid additional heating for toroidal plasmas. M.Somesan (Inst. de Fizica si Tehnologia Materialelor, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.9, p.805-25 (1982). In Rumanian.
A survey of the main features of LHR heating in toroidal plasmas is presented. Theoretical results regarding the penetration of waves and their coupling to the Tokamak plasmas are reviewed and some technical problems related to the generation, transmission and launching of LH waves are discussed. (144 refs.)

Ablative acceleration of pellet shells irradiated by external soft X-ray sources ....See Entry 65667

The effect of localised wave power absorption on ECRH driven currents in a Tokamak ....See Entry 66687

ICRF heating and its effect on single-particle confinement in Tokamaks ....See Entry 66735

Attainment of reactor level volume-averaged toroidal beta in Doublet III ....See Entry 66737

Macroscopic plasma behavior in a high-voltage toroidal theta pinch ....See Entry 66741

Evolution of the m=1 tearing mode during internal sawtooth disruption ....See Entry 66754

52.50J Plasma production and heating by laser beams

66719 Non-Maxwellian electrons in a laser produced sodium plasma. W.Lowell Morgan (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.790-1 (1 May 1983).
Time-dependent Boltzmann calculations of the electron energy distribution function in a laser excited sodium plasma have been performed. Such nonequilibrium plasmas are produced in alkali metal vapor by laser irradiation of the *ns-np* resonance line. The electrons in these plasmas are heated by superelastic collisions with atoms in the *np* state giving a distribution of electrons in energy that is characterized by a series of spikes at energies separated by the *ns-np* transition energy, 2.1 eV for sodium. (16 refs.)

66720 Pulsed megagauss fields produced by laser-driven coils. J.F.Seely (Optical Sci. Div., Naval Res. Lab., Washington, DC, USA).
Appl. Phys. B (Germany), vol.B31, no.1, p.37-43 (May 1983).
The generation of pulsed magnetic fields in the range 20 kG to 2 MG by laser-driven coils is analyzed. Previous experimental results are modeled using a time-dependent circuit equation. By varying the circuit parameters and the coil geometry it is shown that a field of 30 kG and a rate of change of 4 kG/ns can be generated by a small single-turn solenoid driven by a 1 J, 20 ns laser pulse. Using a more energetic laser pulse, a rate of 600 kG/ns is achievable. This value of dB/dt greatly exceeds that available from the more conventional field generation devices and is important for the observation of transient magnetic phenomena. (15 refs.)

66721 Metal plasma induced by the bombardment of 308 nm excimer and 585 nm dye laser pulses at low pressure. K.Kagawa (Faculty of Education, Fukui Univ., Fukui, Japan), S.Yokoi, S.Nakajima.
Opt. Commun. (Netherlands), vol.45, no.4, p.261-5 (15 April 1983).
The characteristics of the plasma induced by the bombardment of laser pulses (4-6 mJ, 10-15 ns) on a metal surface kept in the pressure range (0.1-10 Torr) is studied. The laser induced plasma consists of two distinct regions. One is a small-region plasma (primary plasma), which emits an intense continuous emission spectrum for a few tenths of 0.1 μs. The other is a plasma (secondary plasma) spreading out with time, which emits intense atomic emission spectra. It was found that the displacement length of the front of the secondary plasma is proportional to the two-fifths power of time. This fact indicates that the blast wave plays an important role in the mechanism of forming the luminous secondary plasma. The primary plasma is considered as the source of the blast wave. (7 refs.)

66722 Laser-plasma-induced extreme-ultraviolet radiation from liquid mercury. R.M.Jopson, S.Darack, R.R.Freeman (Bell Labs., Murray Hill, NJ, USA), J.Bokor.
Opt. Lett. (USA), vol.8, no.5, p.265-7 (May 1983).
Extreme ultraviolet (XUV) radiation from 100 to less than 30 nm is emitted from a laser-induced plasma generated on a liquid-mercury surface. This surface does not degrade even after tens of thousands of laser pulses. The 532-nm laser light focused on the mercury surface. The plasma core produces primarily continuum radiation, whereas the plume emits lines at wavelengths above 77 nm. The mercury was generated at the entrance port of a normal incidence vacuum monochromator, and the dispersed XUV radiation was monitored with a photomultiplier tube. (3 refs.)

Limitation of the accuracy of interferometrically measured electron density profiles of laser-produced plasmas .... See Entry 66748

52.55 PLASMA EQUILIBRIUM AND CONFINEMENT

66723 Some physical problems of RF heated Tokamak plasma in a hybrid reactor regime. L.Krlin, P.Pavlo, Z.Tluchor (Inst. of Plasma Phys., Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.429-42 (1983).
The authors present a simple physical model of an RF heated Tokamak and the first estimates of its parameters in a hybrid reactor regime. The plasma is heated by the absorption of lower hybrid waves. Under conditions close to those of a hybrid reactor, they estimate the outgoing power, the power deposited by alpha particles, the RF power absorbed in a plasma (to balance the energy losses), the driven current coupled with the RF absorption, the neutron flux and the production rate of plutonium. The magnitude of the driven current seems to be sufficient to maintain the steady-state regime. (20 refs.)

66724 Joint European Torus (JET)—a major experiment in nuclear fission. E.Bertolini.
Int. Power Generation (GB), vol.6, no.3, p.10-14 (April 1983).
The Joint European Torus now nearing completion of the construction phase near Abingdon in England is an experiment on a large scale. Its purpose is the study of plasma physics and nuclear fusion. JET itself will never produce electric power from nuclear fusion but the work done over the next few years will pave the way for the eventual introduction of commercial fusion power reactors. The author summarises JET in relation to fusion research taking place in other parts of the world, and the accompanying articles cover in more detail the construction of the experimental Tokamak and the provision of power supplies. (no refs.)

66725 The construction of JET.
Int. Power Generation (GB), vol.6, no.3, p.16-17 (April 1983).
A feature which distinguishes JET from other tokamaks in its size. In particular the plasma volume, at 200 m^3, is very much larger than previous tokamaks. The plasma will be established in a toroidal vacuum vessel with a D-shape cross section of 2.5 m×4.2 m high with a major radius of 2.95 m. (no refs.)

66726 Power supplies for JET.
Int. Power Generation (GB), vol.6, no.3, p.17, 19-20 (April 1983).
Since JET is an experiment in plasma physics rather than a commercial fusion reactor, large quantities of power must be supplied in pulses to produce and stabilise a plasma. The peak load is in excess of 700 MW. This is more than could be drawn from the CEGB grid in short pulses, strong though that is, and in consequence, two flywheel storage systems have been built. (no refs.)

66727 Behavior of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. I. Experiment. S.Wexler, E.K.Parks, C.E.Young, R.A.Bennett (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1730-54 (April 1983).
The behavior of a flowing Cs^+-UF_6^- ion-pair plasma in the radiofrequency (RF) quadrupole-dipole fields of a mass filter has been studied experimentally. The flowing plasma was formed by collision of a beam of accelerated UF_6 molecules with an intense beam of thermal Cs atoms. The maximum current (positive- or negative-ion flux) entering the mass filter was 0.5×10^{-3} A, corresponding to a positive- or negative-ion density in the injection region of $\sim1.1\times10^{10}$ ions/cm^3. Four aspects of the interaction of the plasma with the radiofrequency fields were investigated: (1) the injection of the ion-pair plasma into the quadrupole-dipole field, (2) confinement by and transmission of the flowing plasma through a quadrupole field, (3) mass-sensitive ejection of ions from the plasma by superimposed quadrupole and dipole fields, and (4) effects of the extraction and exit fringe fields on the flowing plasma. In particular, the effects of increasing plasma density in relation to the above topics was experimentally determined. The results of the experimental observations in conjunction with the theoretical calculations discussed in the following paper suggest that the limiting-ion flux that can be confined within a quadrupole mass filter is determined by the requirement of the plasma frequency ν_p must be lower than or at most equal to the applied RF quadrupole frequency ν_1. If $\nu_p>\nu_1$, the RF field causes rapid destruction of the plasma. The mass-resolving power of the mass filter was found to deteriorate significantly with increasing plasma throughput, a result of the increasing space-charge forces within the plasma and their interaction with the applied dipole field. (15 refs.)

66728 Behaviour of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. II. Theory. A.F.Wagner (Chem. Div., Argonne Nat. Lab., Argonne, IL, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1755-80 (April 1983).
For pt.I see ibid., vol.54, no.4, p.1730-54 (1983). The behaviour of a flowing Cs^+-UF_6^- ion-pair plasma in the radiofrequency (RF) quadrupole-dipole fields of a mass filter has been studied theoretically. For low-density plasmas, the calculations involved trajectory studies of isolated ions in a quadrupole-dipole fields with or without fringe fields. For high-density plasmas, two-dimensional particle-in-cell trajectory studies were used to self-consistently incorporate space-charge effects into the simulated plasma behaviour in perfect quadrupole-dipole fields uncomplicated by fringe fields. Three aspects of the interaction of the plasma with the radiofrequency fields were investigated: (1) the effects of fringe fields, especially on the injection of the plasma into the quadrupole-dipole field, (2) confinement by and transmission of the flowing plasma through a quadrupole field, and (3) mass-sensitive ejection of ions from the plasma by superimposed quadrupole and dipole fields. For each of these three topics, the theoretical results were compared with the experimental observations, especially with regard to the effect of increasing plasma density. In general, the agreement between theory and experiment is good. The theoretical calculations suggest a limiting current of several hundred microamperes that can be transmitted by the mass filter. The limit is reached when the plasma density increases to the level where the plasma frequency is comparable with the applied RF quadrupole frequency. At higher densities, successive layers of the plasma peel off and are driven out by the applied field until the limiting density is reached. This effect interferes with mass-sensitive ion ejection by the applied dipole field and also induces additional plasma loss in the fringe fields. (16 refs.)

66729 Numerical study of Vlasov equilibrium in a double cusp magnetic field. K.Hamamatsu (Faculty of Sci., Hiroshima Univ., Hiroshima, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1230-41 (April 1983).
Vlasov equilibria of a periodic array of axisymmetric double cusp plasmas are studied numerically for various values of β (ratio of the maximum plasma pressure to the maximum magnetic pressure at midplane of the double cusp vessel). Effects of finite Larmor radius, ambipolar potential and presence of cold plasma component are taken into account. It is shown that the plasma volume expands as β increases, forming a clear transition layer between plasma and vacuum with thickness of the order of the local ion Larmor radius in the high-β case. The stored energy in a single vessel increases rapidly with β. A strong ambipolar potential is formed either in the line cusp region or in the point cusp region, depending on the boundary conditions, and the plasma expands radially in the central region. Cold electrons are gathered in the central region by the ambipolar potential, but the hot plasma component is little affected by the potential. (8 refs.)

66730 Stability of an expanding plasma current shell. A.S.Pleshanov.
Magnetohydrodynamics (USA), vol.18, no.3, p.263-6 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.63-6 (July-Sept. 1982). [received: April 1983]
The concept of a plasma shell with a central current filament (expanding pinch) was derived from experimental data by Komel'kov (1959). Subsequently, experimental results were obtained that confirmed and extended this concept. Calculations have been performed on the expansion of a two-dimensional axially symmetrical plasma current shell in the approximation of an ideally conducting compressible plasma with surface currents. The author examines the stability of such a formation in an approximation linear in the perturbation amplitude for one-dimensional cylindrical expansion. (7 refs.)

66731 Neoclassical theory of alpha-particle transport in the central region of a Tokamak plasma. V.Ya.Goloborod'ko, Ya.I.Kolesnichenko, V.A.Yavorskij (Inst. for Nuclear Res., Acad. of Sci., Kiev, Ukrainian SSR).
Nucl. Fusion (Austria), vol.23, no.4, p.399-406 (April 1983).
A neoclassical theory applicable to the central region of a reactor Tokamak plasma is developed for high-energy alpha-particle transport processes. It is shown that in the neighbourhood of the magnetic axis (and on the axis itself), the alpha-particle bootstrap current, and flux across the magnetic field are non-zero and may be comparable with the corresponding quantities in the region far from the axis. (17 refs.)

66732 Thermal barrier on trapping rate in a tandem mirror. R.Carrera, J.D.Callen (Dept. of Nuclear Engng., Univ. of Wisconsin, Madison, WI, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.433-45 (April 1983).
An analytic expression for the Coulomb collision induced ion trapping rate in the thermal barrier cell of a tandem mirror has been obtained. The overall system is assumed to be maintained in steady state by particle injection in the central cell and charge-exchange pumping in the barrier cell. For small ratios of bounce-to-collision time scales the problem reduces to a series of boundary value problems in the various regions of phase space. For conditions of interest, pitch-angle trapping is dominant and a Lorentz collision operator describe reasonably well the kinetic problem, which is solved using a square-well approximation. The analytic results are found to agree with numerical results within expected limits, on the order of the inverse of the barrier/mirror ratio ($\sim$10 to 20%). (21 refs.)

66733 A pressure profile analysis of high-beta ISX-B Tokamak plasmas using MHD equilibrium geometry. R.M.Wieland, H.C.Howe, E.A.Lazarus, M.Murakami, C.E.Thomas (Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.447-65 (April 1983).
The paper describes a method, as implemented in the computer code ZORNOC, for the analysis of high-beta, non-circular ISX-B Tokamak plasma profiles. Thomson scattering electron temperature and density profiles, obtained at a fixed time into the discharge, are used as a basis for performing a complete energy analysis of the plasma and for obtaining confinement parameters assuming steady-state conditions. Self-consistent models for both magnetohydrodynamic equilibrium and ion power balance are used to obtain internal flux surface and ion temperature profiles, respectively, consistent with all the known diagnostic data. Using boundary conditions consistent with poloidal magnetic measurements, a current profile parameterization is obtained that is consistent with the observed location of the $q=1$ surface as indicated by soft X-ray diagnostics. A specific high-beta discharge is analysed in order to illustrate the procedure. (27 refs.)

66734 Parametric systems analysis of the modular stellarator reactor. R.L.Miller, R.A.Krakowski, C.G.Bathke (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.467-79 (April 1983).
The close coupling in the stellarator/torsatron/heliotron between coil design (winding law, peak field, current density, forces), magnetics topology (transform, shear, well depth) and plasma performance (equilibrium, stability, transport, beta) complicates reactor assessment more than for most magnetic confinement systems. In order to provide an additional degree of resolution of this problem for the modular stellarator reactor (MSR), a parametric systems model has been developed and applied. This model reduces key issues associated with plasma performance, first-wall/blanket/shield and coil design to a simple relationship between beta, system geometry and a number of key indicators of overall plant performance. The results of this analysis can then be used to guide more detailed, multidimensional plasma, magnetics and coil design efforts towards technically and economically viable operating regimes. In general, it is shown that average beta values of $\gtrsim0.08$ may be needed if the MSR approach is to be substantially competitive with other projected approaches to DT magnetic fusion in terms of system power density, mass utilization and cost for total thermal output power around 4.0 GW(th); lower powers will require even higher beta values. (29 refs.)

66735 ICRF heating and its effect on single-particle confinement in Tokamaks. K.W.Whang, G.J.Morales (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.481-97 (April 1983).
Ion cyclotron resonance heating (ICRH) and its intrinsic effect on confinement in Tokamaks is investigated. The stochastic nature of ICRH in the absence of collisions is examined through finite-mapping equations. The threshold RF amplitude for the transition from superadiabatic to stochastic behaviour is found to be exceeded in present-day experiments. The effect of heating on confinement is evaluated by studying the drift orbit changes due to heating with collisions included through a Monte Carlo method. The results indicate that transport induced by the ion cyclotron range of frequencies (ICRF) could be significant at the higher RF power levels planned for the next generation of experiments. (20 refs.)

66736 The confinement of alpha particles in a slightly asymmetric Tokamak reactor. W.N.G.Hitchon, R.J.Hastie (Culham Lab., UKAEA, Abingdon, England).
Nucl. Fusion (Austria), vol.23, no.4, p.533-5 (April 1983).
The effect of magnetic-field 'ripple' on alpha particles trapped in the major radial variation of the magnetic field in a Tokamak reactor is to make their orbits stochastic so that they can escape from the plasma volume extremely rapidly. A guiding-centre orbit-following code is used to investigate the extent of the stochastic region in a reactor with INTOR parameters, and to compare the results so obtained with the predictions of an analytic map developed by Goldston et al. (1981) to model the banana orbits. Although the analytic map qualitatively reproduces the main trends observed in the guiding-centre orbits, differences in detail occur whose origins are discussed. (2 refs.)

66737 Attainment of reactor level volume-averaged toroidal beta in Doublet III. K.H.Burrell, R.D.Stambaugh, T.R.Angel, C.J.Armentrout, F.P.Blau, G.Bramson, N.H.Brooks, R.W.Callis, R.P.Chase, A.P.Colleraine, J.C.DeBoo, D.R.Eames, S.Ejima, E.S.Fairbanks, J.Fasolo, R.K.Fisher, R.L.Freeman, J.R.Gilleland, R.J.Groebner, R.W.Harvey, C.L.Hsieh, R.Hong, G.L.Jahns, J.H.Kamperschroer, J.Kim, A.J.Lieber, J.M.Lohr, J.L.Luzon, M.A.Mahdavi, F.B.Marcus, D.B.McColl, T.McMahon, T.Ohkawa, N.Ohyabu, D.O.Overskei, P.I.Petersen, T.W.Petrie, W.Pfeiffer, J.M.Rawls, L.Rottler, J.T.Scoville, R.P.Seraydarian, R.L.Silagi, J.R.Smith, R.T.Snider, R.D.Stav, T.S.Taylor, T.N.Todd, J.F.Tooker, J.R.Treglio, D.F.Vaslow, J.C.Wesley, S.S.Wojtowicz, S.K.Wong, G.Zawadzki (General Atomic Co., San Diego, CA, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.535-40 (April 1983).
Using a neutral-beam injection power of 3.4 MW, volume-averaged toroidal betas of up to $\langle\beta_T\rangle=4.5\%$ have been obtained in low-toroidal-field, low-q_ψ, vertically elongated discharges in the Doublet III Tokamak. This level of $\langle\beta_T\rangle$ is above the minimum level required for a Tokamak reactor, thus demonstrating that reactor level values of $\langle\beta_T\rangle$ are possible in a Tokamak device. The observed enhancement of $\langle\beta_T\rangle$ with vertical elongation lends confidence in the design of future devices which rely on vertical elongation. (25 refs.)

66738 Improved theory of collisionless particle motion in stellarators. H.E.Mynick (Univ. of Wisconsin, Madison, WI, USA).
Phys. Fluids (USA), vol.26, no.4, p.1008-17 (April 1983).
A theory of particle motion in stellarators is developed which, in contrast to previous work, is both realistic enough to account for collisionless detrapping, yet simple enough that most features of the orbits can be expressed in analytic, reasonably simple formulas. From the study of detrapping, a systematic, complete classification of possible orbit types emerges. The theory is valid for a class of stellarator configurations which contains the standard model traditionally envisaged, as well as somewhat more complex configurations recently found to have favorable transport properties. The reasons for the differences in transport between configurations are elucidated. (13 refs.)

66739 Effects of ambipolar potential on multiple mirror confinement. F.Najmabadi, A.J.Lichtenberg, M.A.Lieberman (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA).
Phys. Fluids (USA), vol.26, no.4, p.1018-27 (April 1983).
The diffusion model for multiple mirror confinement has previously been limited to devices with a large number of cells and high mirror ratios. Ambipolar effects were assumed to reduce the confinement time by the usual factor $[1+Z(T_e/T_i)]^{-1}$. For the ideal multiple mirror regime, in which the mean free path is shorter than the cell length but long compared with the mirror scale length, a new discrete staircase density profile model, without those limitations, has been developed. A theory employing model distribution functions for ion and electron transport in a multiple mirror device has been used. A self-consistent ambipolar potential is included. It has been found that

the ambipolar potential reduces the confinement time somewhat less than the usual ambipolar factor. Special attention is given to the last cell which acts as a boundary condition for the system. The ambipolar potential across the last mirror throat is studied and found to be of the order of 0.3 kT_e. For devices with small numbers of cells, significant improvements over previously calculated multiple mirror confinement times are found. (8 refs.)

66740 Reduction of radial losses in tandem mirrors. J.R.Myra, D.A.D'Ippolito, P.J.Catto (Plasma Res. Inst., Sci. Applications Inc., Boulder, CO, USA).
Phys. Fluids (USA), vol.26, no.4, p.1028-36 (April 1983).
The condition for having strictly omnigenous magnetic fields (zero geodesic curvature and neoclassical step size) is generalized to determine the fields which give the smallest mean square neoclassical step size consistent with given boundary conditions and constraints. Because this transport minimization produces less restrictive field configurations than omnigenity, a wider class of practical applications is possible. An explicit set of ordinary differential equations is obtained for the transport-minimizing vacuum fields in long-thin tandem mirror geometry. Configurations with reduced transport are found at little cost in line averaged interchange stability. Additionally, for these configurations the constraint that no parallel current flow into the center cell (due to the Stupakov effect) may be imposed in a natural way. (17 refs.)

66741 Macroscopic plasma behavior in a high-voltage toroidal theta pinch. D.P.Murphy, G.C.Goldenbaum, C.Chin-Fatt, Y.P.Chong, A.W.DeSilva, H.R.Griem, R.A.Hess, R.L.Merlino (Lab. of Plasma & Fusion Energy Studies, Univ. of Maryland, College Park, MD, USA).
Phys. Fluids (USA), vol.26, no.4, p.1061-70 (April 1983).
The behavior of the implosion and post-implosion phases of two different toroidal high-beta plasma configurations has been investigated. The plasma is produced in a nominally axisymmetric toroidal theta pinch in which a Tokamak-like low-beta plasma is heated and compressed to high beta by a fast-rising toroidal field. The two plasma cases differed from each other by the direction of their initial toroidal magnetic field relative to the direction of the main implosion magnetic field. The purpose of this investigation was to determine what factors govern the development and lifetime of the magnetic configuration during the early time post-implosion phase. It was determined from the q profiles for the parallel field case that the plasma should be unstable to the $m=1$ kink mode, i.e. $q<1$, but the normal outward shift of the plasma with respect to the external conducting wall carried it into the internal vacuum chamber wall before the kink could grow to an observable level. The magnetic fields in the case with the initial toroidal field antiparallel to the main implosion magnetic field exhibited nonaxisymmetric behavior. (13 refs.)

66742 Generation of astron-spherator configuration. K.Narihara, M.Hasegawa, Y.Tomita, T.Tsuzuki, K.Sato, A.Mohri.
Report IPPJ-621, Nagoya Univ., Japan (Jan. 1983), 23 pp.
It is experimentally demonstrated that the Astron-Spherator configuration is formed by injecting a pulsed relativistic electron beam in a toroidal device SPAC-VI with external toroidal and vertical magnetic fields. A plasma is confined in the extended magnetic region produced by a slender core of current carrying energetic electrons. This configuration continued for 40 ms without fatal instabilities. (16 refs.)

66743 Method of Abel inversion for non-circular Tokamak geometrics. N.G.Demas, R.P.Howard, M.E.Plemmons (Tennessee Technol. Univ., Cookeville, TN, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.430-3
A mathematical system is developed for converting line integral experimental data into a point wise distribution (an 'Abel inversion'). The zero boundary location must be given, but it need not be circular. Plasma particles in the ISX-B Tokamak at Oak Ridge are magnetically confined in such a way that a cross-section of the plasma has a D-shaped boundary. Of interest is the distribution of plasma electrons over this cross-section of plasma particles. Previous work has approximated the D-shape by a more or less appropriate circular cross-section. The purpose of this paper is to develop a mathematical system using D-shaped boundary conditions that will yield point wise information from experimental values of integrals obtained through plasma diagnostics of the Tokamak system; specifically, the line integral density as measured by a laser beam phase shift. (3 refs.)

Scaling of critical beta in a Tokamak ....See Entry 65675

A scaling law for the anomalous electron transport in Tokamaks ....See Entry 66680

Spatial diffusion of charged high-energy fusion products by shear Alfven perturbations ....See Entry 66683

Alpha particle loss and energy deposition in tandem mirrors ...See Entry 66684

Drift waves in a straight stellarator ....See Entry 66695

Ion-acoustic waves infinite geometry ....See Entry 66696

Drift-resistive interchange and tearing modes in cylindrical geometry ....See Entry 66698

The whistler instability at relativistic energies ....See Entry 66699

Experimental study of the dissipative trapped ion instability ...See Entry 66701

Linear oscillations in general magnetically confined plasmas ...See Entry 66702

Fast-ion behaviour for quasi-perpendicular high-energy neutral injection into the TFR 600 Tokamak ....See Entry 66714

Current driven by a asymmetrical minority heating in ICRF ...See Entry 66715

Geometry effects on ion heating at ion cyclotron frequencies ..See Entry 66717

Lower hybrid additional heating for toroidal plasmas ....See Entry 66718

The oscillation of the trapped flux in the early phase of a reversed field θ-pinch ....See Entry 66749

Edge-plasma properties of the UCLA Tokamaks ....See Entry 66753

Evolution of the m=1 tearing mode during internal sawtooth disruption ....See Entry 66754

Photographic study of voltage breakdown over an insulator in a hypocycloidal pinch ....See Entry 66765

52.60 RELATIVISTIC PLASMA

66744 Symmetry of the complete second-order nonlinear conductivity tensor for an unmagnetized relativistic turbulent plasma. H.E.Brandt (US Army Electronics Res. & Dev. Command, Harry Diamond Labs., Adelphi, MD, USA).
J. Math. Phys. (USA), vol.24, no.5, p.1332-8 (May 1983).
A new exact symmetry is proved for the complete second-order nonlinear conductivity tensor of an unmagnetized relativistic turbulent plasma. The symmetry is not limited to principal parts. If Cerenkov resonance is ignored, the new symmetry reduces to the well-known symmetry related to the Manley-Rowe relations, crossing symmetry, and nondissipation of the principal part of the nonlinear current. Also, a new utilitarian representation for the complete tensor is obtained in which all derivatives are removed and the pole structure is clearly exhibited. (57 refs.)

The whistler instability at relativistic energies ....See Entry 66699

52.65 PLASMA SIMULATION

Electromagnetic radiation from beam-plasma instabilities ....See Entry 66688

Fast-ion behaviour for quasi-perpendicular high-energy neutral injection into the TFR 600 Tokamak ....See Entry 66714

Behaviour of Cs^+-UF_6^- ion-pair plasmas in radiofrequency quadrupole-dipole fields. II. Theory ....See Entry 66728

52.70 PLASMA DIAGNOSTIC TECHNIQUES AND INSTRUMENTATION

66745 Spectroscopic studies of the hollow cathode discharge. W.Zyrnicki, E.Osinska (Tech. Univ. of Wroclaw, Wroclaw, Poland).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B32, no.11, p.1303-4 (1982).
The excitation temperatures of plasma produced in a hollow cathode discharge have been determined from relative intensities of ArII and FeI lines. The intensity ratios of some analytical line pairs have been investigated. The authors determine plasma temperature by measurements of ArII and FeI line intensities and investigate the intensity ratios of some analytical line pairs. (9 refs.)

66746 Damping of the plasma resonance of a probe in a drifting Maxwellian plasma. V.Fiala (Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B32, no.11, p.1305-6 (1982).
The response of a probe (small antenna) to harmonic excitation depends on its relative motion with respect to the plasma and this effect may be useful in determining plasma drift velocity. The results of computation of the real part of the transfer impedance of a symmetric probe are presented. (1 ref.)

66747 Langmuir probe characteristic modulated with random fluctuations. K.Matsumoto, M.Sato (Dept. of Electrical Engng., Yamagata Univ., Yamagata, Japan).
J. Appl. Phys. (USA), vol.54, no.4, p.1781-6 (April 1983).
Distortion of the Langmuir probe characteristic due to random fluctuations is investigated theoretically and experimentally. A statistical method is newly introduced to reasonably take account of the effects of statistically random processes. When the fluctuations in the plasma parameters and the current flowing to a Langmuir probe are ergodic, the time-averaged probe current is obtained by taking an ensemble average of the probe current weighted by the probability density function of fluctuating parameters. Therefore, the analysis is valid only for fluctuation spectra with frequencies small compared with the ion plasma frequency. Calculations are made for the distortion of the electron probe current due to Gaussian or periodic fluctuations in number density, space potential, and electron temperature. Previous results based on the usual time average can be deduced from the statistical method as special cases. The method is also examined experimentally by applying broadband Gaussian or periodic potential fluctuations to the plasma of a mercury discharge tube. It is found that Gaussian fluctuations in the plasma parameters bring about greater distortion to the electron probe characteristic than periodic ones, such as sinusoidal, rectangular, triangular waves. (9 refs.)

66748 Limitation of the accuracy of interferometrically measured electron density profiles of laser-produced plasmas. M.D.J.Burgess, G.B.Gillman, B.Luther-Davies (Dept. of Engng. Phys., Australian Nat. Univ., Camberra, Australia).
J. Appl. Phys. (USA), vol.54, no.4, p.1787-91 (April 1983).
Using a double pulse ultraviolet holographic interferometer the authors have investigated the effects of interferometer focusing accuracy on the measured density profiles in an experimental study of plasmas generated by 20-ps duration neodymium laser pulses on carbon fiber targets. They have found that in accordance with predictions made previously using computer models the critical density region can only be measured accurately in very small spherical plasmas when the interferometer focusing error is less than about 5 μm. (10 refs.)

66749 The oscillation of the trapped flux in the early phase of a reversed field θ-pinch. Chen Wu, Y.Aso, S.Himeno, S.Yamaguchi, M.Okamoto, K.Hirano (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1215-23 (April 1983).
Magnetic probe measurements show that the flux trapped into the neutral sheet radius at the early phase of the reversed field θ-pinch does not decrease monotonically but the two humps appear. The first one is coincident with the formation of the collisionless shock wave while the second one with its reflection at the center. The most probable origin of the electromotive force for these humps may be in the large rotational velocity difference between hydrogen ions and impurities. In the first hump the velocity difference may be excited by the ion runaway (Gurevich) effect coupled with the imploding plasma. In the second hump it may be due to large off diagonal element $P_{r\theta}$ of the ion pressure tensor created at the time of the reflection. (24 refs.)

66750 Measurement of small-scale density fluctuation in JIPP T-II plasma by millimeter and sub-millimeter wave scattering. T.Tetsuka, A.Nishizawa (Inst. of Plasma Phys., Nagoya Univ., Nagoya, Japan), T.Sakai, K.Kawahata, A.Mase, T.Tsukishima, J.Fujita.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1242-50 (April 1983).
The small-scale density fluctuations have been studied by both millimeter (2 mm) and sub-millimeter (337 μm) wave scattering technique in JIPP T-II plasmas. Experiments were performed in two types of plasma: tokamak and stellarator plasmas. In both plasmas, the density fluctuations are localized in the outer region of the plasma column, and show the characteristics of the drift wave mode turbulence. The density fluctuation level is $\tilde{n}/n_0 \simeq 1$-1.5% around the plasma edge, and this value is inversely proportional to the mean electron density. Further, the dependence of the fluctuation level on the plasma parameters is studied and compared with the scaling law of the energy confinement time of the plasma. The diffusion coefficient estimated from the density fluctuation is about one third of the global diffusion coefficient.

66751 Radial density distribution of excited atoms in a surface-wave-produced Ar-O_2 plasma column. A.Ricard, D.Collobert, M.Moisan (Dept. de Phys., Univ. de Montreal, Montreal, Quebec, Canada).
J. Phys. B (GB), vol.16, no.9, p.1657-65 (14 May 1983).
The radial density distribution of Ar I and O I excited atoms in a radiative state and Ar($^3P_2$) metastable atoms in an Ar-O_2 cylindrical plasma column

produced by an electromagnetic surface wave is examined experimentally. The radial density distributions of the Ar($^3P_2$) metastable atoms and that of the O I radiative atoms are nearly flat, whereas the radial variation of Ar I radiative atoms can have a deep minimum on the plasma column axis. The difference in radial profiles leads to the conclusion that the atomic number density in the O(3^3P) level is the result of a two-step process, viz. dissociation of the O_2 molecule and excitation of the ground-state atomic oxygen, this process being caused by Ar($^3P_2$) metastable atoms (rather than by electrons) successively colliding with O_2 and O. The results in Ar-OI_2 are compared with observations made in Ne-O_2. (20 refs.)

66752 Measurement of plasma conductivity using Faraday rotation of submillimeter waves. P.J.Kuzmenko, S.A.Self (Dept. of Mech. Engng., Stanford Univ., Stanford, CA, USA).
J. Energy (USA), vol.7, no.2, p.176-81 (March-April 1983).
This paper examines the application of Faraday rotation to the measurement of electron concentration in combustion MHD plasmas. Details on the design of a working system are given, including the selection of operating wavelength. A theoretical comparison between the Faraday rotation technique and two-path interferometry shows Faraday rotation in its simplest form to be somewhat less sensitive to changes in electron concentration. This deficit can be balanced against greater immunity to vibration and thermal drift. Improved techniques of measuring the rotation angle promise greater sensitivity. A preliminary experiment has verified the technique. (13 refs.)

66753 Edge-plasma properties of the UCLA Tokamaks. S.J.Zweben, R.J.Taylor (Center for Plasma Phys. & Fusion Engng., Univ. of California, Los Angeles, CA, USA).
Nucl. Fusion (Austria), vol.23, no.4, p.513-28 (April 1983).
Probe measurements of the edge plasmas of the Macrotor and Microtor Tokamaks are described. Limiter scrape-off layer thicknesses as measured with Langmuir probes are for Macrotor $\lambda \simeq 7$-10 cm and for Microtor $\lambda \sim 1$ cm, both values being consistent with the Bohm diffusion rate. Heat deposition measured with thermocouples attached to small probes shows an anomalously high heat flux, particularly from the electron drift direction. It is argued that the anomalous particle diffusion is most likely associated with the large edge density fluctuations, while the anomalous heat flux is most likely due to a directed high-energy electron population. (59 refs.)

66754 Evolution of the $m=1$ tearing mode during internal sawtooth disruption. P.Smeulders (Max-Planck-Inst. fur Plasma Phys., Garching, Germany).
Nucl. Fusion (Austria), vol.23, no.4, p.529-32 (April 1983).
With an ultra-soft X-ray pinhole camera installed on the Wendelstein VII-A stellarator, changes of the plasma topology have been measured for various plasma conditions over several years. A recently finished tomography computer code, specifically written for pinhole cameras, has yielded detailed information about the time evolution and structure of tearing modes during internal and external disruptions. The features of the $m=1$ tearing mode during an internal sawtooth disruption in a current-carrying stellarator plasma during neutral beam injection are presented. (9 refs.)

66755 Absorption of intense gaussian electromagnetic radiation in a magnetoplasma via inverse bremsstrahlung. K.P.Maheshwari, G.Tarey, R.K.Tiwari (Dept. of Phys., Government Coll., Kota, India), R.P.Sharma.
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.623-35 (Nov. 1982). [received: April 1983]
A self-focused Gaussian laser beam propagating in the direction of static magnetic field in a collisional magnetoplasma has been considered. The explicit expressions for the time averaged power absorbed for left and right handed circularly polarised waves have been obtained. The effect of magnetic field and focusing on the rate of powder absorbed is studied in weak field regime ($\nu_E \ll \nu_{Th}$) as well as strong field regime ($\nu_E \gg \nu_{Th}$). (15 refs.)

66756 Accuracy of mass spectrometric low-temperature plasma diagnostics. S.L.Pozharov (Inst. of Nuclear Phys., Acad. of Sci., Tashkent, Uzbek SSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1327-30 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2156-62 (Nov. 1982). [received: May 1983]
The author discusses a method for selecting ions from a high-pressure plasma which is optimal in terms of minimizing distortions. A simple model is suggested for describing the perturbed plasma adjacent to the outlet. The mass flow and chemical reactions involving the ions are treated to determine how the plasma near the outlet influences the accuracy of mass spectrometric measurements. The relation between the ion density in the unperturbed plasma and the ion currents at the outlet is determined for several ion selection regimes. Dimensionless equations are found which relate the experimental parameters under different ion-selection conditions. (11 refs.)

66757 Reconstruction of the structure of the X-ray spectrum of a laser plasma by mathematical processing. N.Yu.Bakaev, N.G.Basov, V.P.Varava, A.I.Veretennikov, E.I.Ershov, M.P.Kalashnikov, Yu.A.Mikhailov, A.V.Rode, G.V.Sklizkov, R.P.Tarasov, S.I.Fedotov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1378-83 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2119-26 (Nov. 1982). [received: May 1983]
A method is suggested for the reconstruction of the structure of an X-ray spectrum broadened by the influence of a plasma source and by the recording channel. The new method requires less calculation time than the previous methods for the processing of experimental data involving local regularization. This advantage is due to a numerical procedure of the reconstruction method based on a semigroup scheme. The application of the new method in the reconstruction of the k and j satellites of the He-like Al XII ion in the X-ray spectrum of a laser plasma observed in the Delfin facility ensured an improvement in the spectral resolution by a factor of 2-5. (19 refs.)

Spectroscopic determination of the viscosity of a fully ionized plasma by means of the dynamics of acceleration by a traveling wave ....See Entry 66685

Observations of plasma rotation in the high beta Tokamak Torus II ....See Entry 66692

Repopulation kinetics of intermediate levels in CO_2 laser helium grow discharge interaction ....See Entry 66708

A pressure profile analysis of high-beta ISX-B Tokamak plasmas using MHD equilibrium geometry ....See Entry 66733

Method of Abel inversion for non-circular Tokamak geometrics ....See Entry 66743

Langmuir probe measurements on CHF_3 and CF_4 plasmas: the role of ions in the reactive sputter etching of SiO_2 and Si ....See Entry 66759

Mass spectrometry of high pressure arcs in air and SF_6 ....See Entry 66766

Experimental evidence of non-inverted population in a neon hollow-cathode ....See Entry 66771

Test wave diagnostics in the afterglow of a microwave discharge ....See Entry 66772

52.75 PLASMA DEVICES AND APPLICATIONS

(see also 28.52 Fusion reactors, 86.30L Electrogasdynamic and magnetohydrodynamic conversion; for ion sources, see 29.25 Particle sources and targets)

66758 Spectroscopic Doppler-free methods for measuring the electric and magnetic fiels in magnetically insulated ion diodes. Y.Maron, C.Litwin (Lab. of Plasma Studies, Cornell Univ., Ithaca, NY, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2086-92 (April 1983).
A two-photon absorption technique is proposed for the measurement of the Stark shift and the Zeeman splitting of the ion energy levels in the diode acceleration gap of a magnetically insulated ion diode for the purpose of determining the local electric and magnetic fields. Various measurement schemes are discussed. The required laser power and linewidth are estimated and found to be attainable by the present day lasers. A measurement of the ion transverse velocities in the diode gap is also proposed. (20 refs.)

66759 Langmuir probe measurements on CHF_3 and CF_4 plasmas: the role of ions in the reactive sputter etching of SiO_2 and Si. C.Steinbruchel (RCA Ltd., Zurich, Switzerland).
J. Electrochem. Soc. (USA), vol.130, no.3, p.648-55 (March 1983).
Langmuir probe measurements on CHF_3, CF_4, CF_4-H_2 and CF_4-O_2 plasmas with concurrent etch rate measurements on SiO_2 and Si have been made in a reactive sputter etching system. At an RF power of 300 W and a pressure of 15 mTorr, the ion density is typically 1.5×10^{10} cm^{-3}, the electron temperature 2 eV, the plasma potential 30 eV, and the ion energy (i.e. the sheath potential) of the order of 500 eV. The dependence of these parameters on RF power, pressure, reactor geometry, and plasma gas composition is investigated, as well as the spatial uniformity of the plasma. For SiO_2, etch rates vary essentially in proportion to ion densities with all the different plasmas. For Si in CF_4-O_2 plasmas, the anisotropic part of the etch rate also parallels the ion density. From the measured ion densities the ion flux to the substrate is estimated. Thus, etch rates per ion can be determined, which turn out to be similar to those in reactive ion beam etching, although in reactive sputtering etching ion energies are much smaller. (37 refs.)

66760 Analytical investigation of axial field limitations in MHD generators. W.Unkel, C.H.Kruger (Stanford Univ., Stanford, CA, USA).
J. Energy (USA), vol.7, no.2, p.97-8 (March-April 1983).
Electrical breakdown of the interelectrode insulator gap of an MDH generator is represented by a time-dependent thermal and electrical model for the regions. Predicted results for a simplified configuration are in general agreement with available experimental data. MHD generator electrode wall design philosophies are evaluated. (9 refs.)

66761 Cross-sectional current distribution in coal fired diagonal conducting wall MHD generator. A.R.Kumaran, B.L.Liu, Y.C.L.Wu (Univ. of Tennessee Space Inst., Tullahoma, TN, USA).
J. Energy (USA), vol.7, no.2, p.112-17 (March-April 1983).
Current distribution in the cross-sectional plane of a diagonal conducting wall MHD generator with slag coated walls, is studied. The effects of boundary layer thickness and wall temperature on the current distribution and power output are investigated for magnetic fields of 2 and 6 T. The effect of sidewall boundary layer overshoot is also considered. For a cold wall there is substantial current flow to the sidewalls, whereas for a hot wall there is much less such a trend. The change in the thickness of the turbulent boundary layer has little effect on the current distribution and power output. Increasing the Hall parameter enhances the sidewall current significantly. Power output is strongly dependent on the wall temperature since the voltage drop increases rapidly as wall temperature decreases. The temperature distribution in the slag layer varies with the current density for a specified wall temperature. There is no substantial current leakage through the slag layer between the various electrodes along the sidewall in all the cases considered. The power output from the present investigation compares well with the experimental results and also with three-dimensional results. (17 refs.)

66762 MHD channel electrical boundary-layer theory and applications. S.A.Zwick, E.D.Doss, Y.C.Pan, S.E.Shamma (Argonne Nat. Lab., Argonne, IL, USA).
J. Energy (USA), vol.7, no.2, p.118-27 (March-April 1983).
Analytical methods are developed for calculating the potential and currents near boundary singularities caused by electrode edges or abrupt drops in conductivity or in the induction field. A three-dimensional control volume (finite-difference) model which applies the analysis for solving the magnetohydrodynamic electrical problem in oblique coordinates has been developed. The model accounts for the near-wall singular behaviour accurately and can be used with relatively sparse grids to study channels with diagonal sidewall conductors. Analyses based on the model indicate that, for practical generator design where the electrode pitch is on the order from 1 to 5 cm and the wall temperature less than 2100K, the performance of diagonal conducting wall channels is always superior to that of channels with insulating sidewalls, although the performance of insulating sidewall channel is better at higher wall temperatures. Sidewall electrode extensions up to a wraparound of about 20% of the channel height are shown to cause an increase in power output. The power output of diagonally connected channels remains approximately the same for more than 20% wraparound, whereas the power output of Faraday channels drops off with further extensions of the sidewall conductors. (11 refs.)

66763 End effect in segmental channel. S.M.Barbarash, V.A.Golodnyak, S.Yu.Reutskii, I.M.Tolmach.
Magnetohydrodynamics (USA), vol.18, no.3, p.304-8 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.111-14 (July-Sept. 1982). [received: April 1983]
Design of MHD devices with segmental channels necessarily involves study of the characteristics of a given machine in the end zone near the current-feeding electrodes and in the region of dropping intensity of the applied magnetic field. One such problem has already been solved. For high-voltage MHD pumps, however, the formulation of the problem in that study does not adequately describe the real processes in a machine. Specifically, it does not account for the finite resistance of connecting jumpers and does not include the insulating gaps which separate a current-feeding electrode from the segmental channel part. The problem of the end zone in a segmental channel with an isotropically conducting medium is solved in the two-dimensional formulation and in the inductionless approximation. (5 refs.)

66764 Experimental study of conduction-type MHD-channel operating with electrolyte. A.P.Vasil'ev.
Magnetohydrodynamics (USA), vol.18, no.3, p.315-21 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.122-8 (July-Sept. 1982). [received: April 1983]
Channel-type MHD conduction motors with superconducting magnets can operate as high-efficiency thrust engines. The energy characteristics and efficiency of these motors were, however, calculated without taking into account the evolution of gases at the electrodes resulting from electrolysis of sea water. The need to study these processes is dictated by the designers' endeavor to increase the thrust delivered per unit volume of the magnetic field, a very important performance parameter of an MHD motor. Achieving this will make it possible to decrease the volume of the MHD channel as well as the mass and the size of the superconducting magnet system, but will also increase the operating current density in the channel and thus the volume fraction of gaseous phase in the latter. A higher bubble content in the carrier stream results in a velocity imbalance between phases and in a lower effective electrical conductivity of the working substance, accompanied by additonal losses of electrical and mechanical power in the channel with attendant lowering of the motor efficiency. (8 refs.)

66765 Photographic study of voltage breakdown over an insulator in a hypocycloidal pinch. D.R.McFarland (NASA Langley Res. Center, Hampton, VA, USA), J.H.Lee.
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.444-7
In order to improve the discharge uniformity in a multiple-stage hypocycloidal pinch (HCP) that is used as a laser pump source, the initial breakdown over an annular surface of the insulator in the HCP was investigated by fast photography. This study was made using a single pair of electrodes with variations in electrode configurations, insulator markings, gas medium in pressures (1 to 500 kPa), and electrode potential (2 to 10 kV). The heavier gases, such as Xe and Ar, higher gas pressures (above 100 kPa), and higher potentials gave more uniform discharges. Also, the initial breakdown was highly affected by radial conductive markings spaced around the insulator. (3 refs.)

Resistive force acting on a microscopic particle in a low-temperature plasma jet ....See Entry 66689

Parametric systems analysis of the modular stellarator reactor ....See Entry 66734

Measurement of plasma conductivity using Faraday rotation of submillimeter waves ....See Entry 66752

52.80 ELECTRIC DISCHARGES

(see also 51.50 Electrical phenomena in gases)

66766 Mass spectrometry of high pressure arcs in air and SF_6. W.Ruegsegger, F.K.Kneubuhl (Dept. of Phys., ETH, Zurich, Switzerland), H.J.Schotzau.
Appl. Phys. B (Germany), vol.B31, no.1, p.9-13 (May 1983).
For the development of SF_6 pufferbreakers it is important to gain insight into the chemical composition of the SF_6 gas during the high-current period as well as close to current zero. For this reason a mass-spectrometric sampling system is presented which allows dynamic measurements of chemical reactions occurring in high-pressure arcs. Results of mass-spectroscopic investigations on a DC and a pulsed arc are presented. (13 refs.)

66767 Characteristics of a discharge in a He-CO_2-Cs mixture and their effects on the rate of chemical combination of cesium. V.A.Sinel'shchikov (Inst. of High Temperatures, Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.517-24 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.627-35 (July-Aug. 1982). [received: April 1983]
The discharge plasma in a He-CO_2-Cs mixture has been examined with partial pressures for the components of $pHe=2.7$ kPa and $pCO_2=(0\text{-}270)$ Pa, and atomic cesium concentrations in the range $N=(10^{10}\text{-}2\times10^{13})$ cm^{-3}. It has been found possible to obtain a quasistationary plasma in a He-CO_2-Cs mixture with an atomic cesium concentration sufficient to affect the electron concentration and temperature. Measurements have been made of the characteristic combination times for the cesium in the discharge. (11 refs.)

66768 Voltage drop at the cathode of a glow discharge at moderate pressures in nitrogen and in a mixture of CO_2-laser gases. A.I.Ivanchenko, A.A.Shepelenko (Inst. of Theoretical & Appl. Mech., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.525-30 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.636-41 (July-Aug. 1982). [received: April 1983]
It is shown, using theoretical estimates which are confirmed experimentally, that the magnitude of the voltage drop of a glow discharge at the cathode can be measured at moderate pressures by calorimetrically measuring the heat evolved on the cooled cathode. Measurements are reported in a CO_2:N_2:He mixture and in N_2 at different discharge currents. (8 refs.)

66769 Normal glow discharge burning regime. V.I.Myshenkov (Inst. for Mech. Problems, Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.530-5 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.642-8 (July-Aug. 1982). [received: April 1983]
The nature of the normal burning regime for glow discharges is investigated. The effects of gas heating mechanisms on the structure of the cathode layer are studied. At relatively low pressures when heating of the gas in the cathode layer is not substantial, simple equations are derived to give the width of the cathode layer, size of the cathode voltage drop, and normal current density. All the values thus obtained are in agreement with experimental data. (9 refs.)

66770 Experimental study of an axial discharge in a turbulent gas flow. A.V.Bondarenko, F.V.Lebedev, M.M.Smakotin, V.B.Flerov (I.V. Kurchatov Atomic Energy Inst., Moscow, USSR).
High Temp. (USA), vol.20, no.4, p.536-9 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.649-52 (July-Aug. 1982). [received: April 1983]
The electric field intensity distribution is studied in an extended small-field discharge in nitrogen. Expressions are obtained for the dependences of the electric field gradient on pressure, flow velocity, current density, turbulent diffusion factor, and discharge tube diameter which are in good agreement with theoretical treatments of the mechanism by which current passes into the extended region of a small field. The results may be of use in studying stability of axial discharges. (8 refs.)

66771 Experimental evidence of non-inverted population in a neon hollow-cathode. T.Caesar, J.-L.Heully (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Opt. Commun. (Netherlands), vol.45, no.4, p.258-60 (15 April 1983).
By the use of two step excitation from the $(2p^5\ 3s)^1P_1$ state of neon very large enhancements of the optogalvanic signals were obtained. This proves that no inverted population between the levels $2p_{1,2,3,4,5}$ and $^1P_1$ occurs as it was proposed in a recent paper. A new explanation of the inverted optogalvanic signals obtained for transitions originating from this $^1P_1$ state is proposed. (4 refs.)

66772 Test wave diagnostics in the afterglow of a microwave discharge. G.Derra, A.Piel (Inst. fur Experimentalphys. II, Ruhr Univ. Bochum, Bochum, Germany).
Plasma Phys. (GB), vol.25, no.4, p.435-46 (April 1983).
The plasma parameters n_e, T_e, T_i of a microwave produced plasma are investigated using resonance cones and ion acoustic waves. Both methods were refined to make possible time resolved measurements during the afterglow. The electron densities derived from resonance cones agree well with microwave interferometry. The ion acoustic wave method results in much lower electron temperatures than Langmuir probes. This behaviour is attributed to high concentrations of molecular ions, which reduce the ion acoustic speed. (16 refs.)

66773 Current-voltage characteristics of a high-current discharge in nitrogen. V.S.Borodin, O.P.Nechesov, F.G.Rutberg (All-Union Sci.-Res. Inst. for Electrical & Mech. Engng., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1324-7 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2150-5 (Nov. 1982). [received: May 1983]
A model is suggested for high-current discharges under high pressure initiated by an exploding wire in nitrogen when energy is supplied by an inductive power source. The pulse length and current pulseform in such discharges permit the use of a quasistationary model. It is shown that if a constantan wire is exploded, the discharge may be considered to consist of two zones—a central zone in which the temperature is weakly dependent on the radial distance, and a wall region, where the temperature drops abruptly. Calculated values of the conductivity are compared with experimental findings for currents in the range 10-90 kA at initial pressure 2 MPa, and satisfactory agreement is obtained. (10 refs.)

66774 Experimental investigation of the characteristics of a planar surface discharge. V.M.Borisov, A.M.Davidovskii, O.B.Khristoforov.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1403-8 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2159-67 (Nov. 1982). [received: May 1983]
An investigation was made of the optical and electrical characteristics of a planar surface discharge suitable for use in lasers. The optimal times and discharge input energies were determined for which the efficiency of conversion of electrical energy into 240-340 nm ultraviolet radiation energy was 5.5, 3.5, and 1.25% respectively, for $Xe:F_2=10:1$, $Ar:F_2=10:1$, and $He:F_2=10:1$ gas mixtures at atmospheric pressure. A chemical laser system was proposed employing initiation by a planar surface discharge. The possibility was investigated of increasing the fraction of ultraviolet radiation by forming excimer complexes of the type KrF* and XeCl* in the surface discharge plasma. For an $HCl:Xe:Ar=1:1:30$ gas mixture the surface-discharge optical radiation came predominantly from the excimer molecules when the specific input energy was <5 mJ/cm^2. The possibility was demonstrated of utilizing a surface discharge in excimer flashlamps of high repetition frequency (up to ~10 kHz) and emitting ultraviolet radiation of surface power density ~0.3 W/cm^2. (5 refs.)

66775 Breakdown prediction in compressed SF_6. G.C.Crichton, I.W.McAllister, A.Pedersen, S.Vibholm (Dept. of Phys., Tech. Univ., Lyngby, Denmark).
Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82), Odense, Denmark, 1982 (Stockholm, Sweden: ASEA 1982), p.1/1-13
The derivation of the streamer breakdown criterion is described. The criterion is formulated to take account of the inherent features of the effective coefficient of ionization $\bar{\alpha}$. The evaluation of the parameters necessary for the application of the criterion to SF_6 is undertaken. The utilisation of the criterion with respect to the effect of electrode surface roughness on the insulation strength is discussed. Particular reference is made to the limitations inherent both in the modelling procedure adopted and in the use of the breakdown criterion. (7 refs.)

66776 Flashover on a solid resistance surface. C.Huraux, G.Peyregne, A.Rahal (Lab. de Genie Electrique, Univ. Paul Sabatier, Toulouse, France).
Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82), Odense, Denmark, 1982 (Stockholm, Sweden: ASEA 1982), p.2/1-12
Measurements carried out on a laboratory model clarify the essential role of the atmosphere in which the discharge burns while lengthening. Time-to-flashover characteristics reinforce the hypothesis of two mechanisms for discharge root propagation. One is a force dragging the discharge when applied voltage just exceeds the flashover voltage. The other occurs at much higher voltages and consists of successive breakdowns in the atmosphere above the pollution. (12 refs.)

66777 The influence of metallic particles and contamination on the DC flashover of epoxy resin spacers in air and SF_6. G.Grannstrom, E.San Roman (Royal Inst. of Technol., Stockholm, Sweden), A.E.Vlastos.
Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82), Odense, Denmark, 1982 (Stockholm, Sweden: ASEA 1982), p.3/1-11
The influence of metallic particles (copper wires 0.1-0.5 mm in diameter 0.75-3 mm long) and mineral oil smears adhering to the surface of a flat disc spacer was examined. The measurements in air were made at atmospheric pressure (1 bar_a) with the spacer mounted between two coaxial cylindrical Al electrodes with diameters of 155/42 mm. The measurements in SF_6 were made at low pressures (0.1-0.5 bar_a) with the spacer mounted as in air and at pressures 0.2-2 bar_a with the effective diameter of the spacer reduced by using an outer electrode with a diameter of 85 mm. (1 ref.)

66778 DC flashover of epoxy resin spacers in air and SF_6. A.E.Vlastos (Tech. Univ. of Denmark, Lyngby, Denmark), E.San Roman, G.Brannstrom.
Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82), Odense, Denmark, 1982 (Stockholm, Sweden: ASEA 1982), p.4/1-14
The DC flashover voltage of flat and ridged type epoxy resin spacers was examined at atmospheric pressure (1 bar_a) with the spacers placed between two coaxial Al electrodes with diameters of 155/42 mm and an outer electrode length of 200 mm. Experiments were performed in SF_6 using the same spacers and electrodes at pressures of 0.1 to 0.5 bar_a. Additional measurements were performed when the effective spacer length was reduced by shor-

tening the outer electrode diameter to 85 mm but keeping the inner electrode diameter the same (85/42 mm) at pressures of 0.2 to 2 bar_a. (no refs.)

66779 Flashover along interfaces between solid and liquid insulation. H.Danielsen, L.Lundgaard, M.U.Anker.
Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82), Odense, Denmark, 1982 (Stockholm, Sweden: ASEA 1982), p.5/1-11 In Norwegian.
The report presents results from tests of flashover along solid/liquid interfaces (pressboard/transformer oil). The test objects are representative of transformer insulation. The test tank contains 600 l of oil which can be filtered and dried in a closed-loop system, thereby keeping the moisture and particle contents below prescribed limits. The 50 Hz test voltage is increased in steps of 25 kV every minute. Maximum test voltage is 350 kV. During the tests partial discharges are detected and the flashover voltage is recorded. The flashover process is also monitored on a video tape recorder. Test objects with a pressboard/oil interface gave about 14% lower breakdow voltage than a corresponding oil gap with no interface. This result is 'probably significant' according to Student's t test. Some future experiments are discussed. (2 refs.)

Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82) .... See Entry 64590

Formation and destruction of the $O_2(b^1\Sigma_g{}^+)$ metastable state in the positive column of a glow discharge in oxygen .... See Entry 65902

Preionization kinetics of an X-ray preionized XeCl gas discharge laser .... See Entry 66259

Estimation of the minimum laser linewidth achievable with a grazing-grating configuration .... See Entry 66313

Repopulation kinetics of intermediate levels in CO_2 laser helium grow discharge interaction .... See Entry 66708

Spectroscopic studies of the hollow cathode discharge .... See Entry 66745

Decomposition products of silicone liquid due to electric discharge .... See Entry 68126

R.F. plasma reactions in light hydrocarbons: effect of the input power on the decomposition of ethane .... See Entry 68774

Compositional characterization of microwave plasma a-Si:H films .... See Entry 68817

60.00 CONDENSED MATTER: STRUCTURE, THERMAL AND MECHANICAL PROPERTIES

Physics of Non Crystalline Solids. Proceedings of the 5th International Conference .... See Entry 64580

61.00 STRUCTURE OF LIQUIDS AND SOLIDS; CRYSTALLOGRAPHY

(see also 68.20 Solid surface structure, 71. Electron states)

61.10 X-RAY DETERMINATION OF STRUCTURES

(see also 61.80 Radiation damage and other irradiation effects; for specific determinations, see 61.55 to 61.80)

61.10D Theories of diffraction and scattering

On the estimation of X-ray extinction changes due to randomly distributed dislocations in crystals .... See Entry 66996

61.10F Experimental techniques

(inc. apparatus, techniques and calculation methods for analyzing experimental results; see also 07.85 X-ray, gamma-ray instruments and techniques)

66780 An analytical method for indexing X-ray powder patterns of monoclinic substances. Guo Chang-lin, Ma Li-tai (Shanghai Inst. of Ceramics, Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.1, p.1-14 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
A simple and flexible analytical method for indexing X-ray powder patterns of monoclinic substances by using a computer is proposed. The lattice parameter b can be obtained from the repeat number m of δ value of every pair of diffraction lines in δ-m chart and their linear relationship. By the reducing procedure the reciprocal lattice is projected on the a^*-c^* plane and the angle of each pair of reciprocal vectors can be calculated from the Q_{hkl} data of each triplet of reciprocal points. According to the repeat number M in β-M chart the monoclinic angle β can be obtained and then the lattice parameters a and c can be calculated. Finally the indexing of the entire diffraction patterns is made by iterative correction method for indexing powder patterns. The computer program of the analytical method is given. The indexing of two monoclinic substances nickel acetate hydrate ($C_4H_6NiO_4.4H_2O$) and potassium tungstate (K_2WO_4) has been made by using this method, the result proves that the method is fairly applicable. (12 refs.)

66781 Modification of the Stokes method of extracting physical broadening of diffraction lines. L.L.Burkovskaya, I.G.Zakharchenko, O.I.Inozemtsev, I.A.Moroz (Makarenko Sumskii State Pedagogic Inst., USSR).
Ind. Lab. (USA), vol.48, no.7, p.677-80 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.40-2 (July 1982). [received: March 1983]
The problem of regaining the method of Fourier analysis of X-ray line profiles is investigated. A modification of the Stokes method is recommended which produces formulae which are not only free from the errors known to be inherent in such formulae, but also are the simplest, thus shortening the calculation process. (5 refs.)

66782 A nomogram for evaluating the accuracy of determination of the center of gravity of the diffraction line. Yu.D.Yagodkin (Moscow Inst. of Steels & Alloys, Moscow, USSR).
Ind. Lab. (USA), vol.48, no.7, p.680-2 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.42-4 (July 1982). [received: March 1983]
Presents a method of accurate determination of the lattice spacing of crystalline matter based on finding the center of gravity of diffraction lines $2\theta_c$. (2 refs.)

66783 A precision two-crystal X-ray spectrometer for producing oscillation curves. V.E.Panchenko, V.A.Ushakov (Inst. of Nuclear Phys., Acad. of Sci., Novobirsk, USSR).
Ind. Lab. (USA), vol.48, no.7, p.683-7 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.44-7 (July 1982). [received: March 1983]
The described spectrometer contains three separate vertical shafts, i.e., problems of the three-crystal method can also be solved. The shafts are equipped with crystal holders. The first two shafts are assembled on the common platform which can be moved over a large distance along a straight line (with an angular error of $\lesssim 1'$) and secured; the position of the third shaft cannot be changed. The nonparallelism of the axes of rotation of the shafts is $<0.5'$. The angular misalignment of the base walls of the crystal holders with the axes of rotation of the shafts is less than 20″ and the linear misalignment is less than 20 μm. (2 refs.)

66784 Low-angle X-ray camera for the investigation of polymers exposed to loads and ultraviolet radiation. Kh.Akimbekov, A.A.Yastrebinskii (V. I. Lenin Tadzhik State Univ., Dushanbe, USSR).
Ind. Lab. (USA), vol.48, no.7, p.687-9 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.47-8 (July 1982). [received: March 1983]
The camera is based on a collimation system combined with a deflector in order to reduce the background noise, and uses a sharp-focus BSV-10 X-ray tube. The housing of the camera is cylindrical. The camera is opened from the side; which allows all the operations required to be carried out within the camera (installation of the specimen and of the UV source, loading, etc.). A PRK-4 quartz-mercury lamp is used as the source of UV radiation which is supplied from a high-frequency generator with a frequency of 40 MHz and an output of 150 W. (7 refs.)

Intrinsic limitations of diffraction methods for the study of noncrystalline structures .... See Entry 66835

Precision lattice parameter determination of coloured quartz monocrystals .... See Entry 66943

Characterization by X-ray topography of subsurface deformation in abrasive wear .... See Entry 67334

Diffractometer determination of the fine-structure parameters in surface layers of a material .... See Entry 68710

X-ray fluorescence analysis with a linear polarized beam after Bragg reflection from a flat or a curved single crystal .... See Entry 68840

61.12 NEUTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

66785 Double reflection from $SrTiO_3$ [neutron diffraction]. S.Hoshino, H.Fujishita.
Solid State Phys. (Japan), vol.18, no.1, p.39-42 (Jan. 1983). In Japanese.
Extra reflections found in neutron diffraction patterns of $SrTiO_3$ below 105K were reexamined and it was established that they are caused by 'double reflection'. (6 refs.)

Features and performance of a gravity spectrometer for ultracold neutrons .... See Entry 65818

Intrinsic limitations of diffraction methods for the study of noncrystalline structures .... See Entry 66835

61.14 ELECTRON DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

61.14D Theories of diffraction and scattering

Large-angle electron-energy-loss spectroscopy with the inclusion of a surface image potential .... See Entry 68373

61.14F Experimental diffraction and scattering

Processor controlled multichannel microdensitometry for gas electron diffraction patterns .... See Entry 64941

61.14H Low-energy electron diffraction (LEED) and reflection High-energy electron diffraction (RHEED)

66786 Temperature dependence of the 00 LEED beam from the *X*-cut surface of α-SiO_2. V.F.Zadontsev, G.K.Zyryanov (A.A. Zhdanov State Univ., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1794-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3164-6 (Oct. 1982). [received: April 1983]
The authors report the results of an investigation of the temperature dependence of the intensity of the 00 diffraction beam from the X-cut surface of αSiO_2. The measurements were carried out in an apparatus designed for the study of the structure and the dynamics of crystal surfaces by the method of low energy electron diffraction. (9 refs.)

New method for the analysis of reflection high-energy electron diffraction: α-Sn(001) and InSb(001) surfaces .... See Entry 67324

61.16 OTHER DETERMINATION OF STRUCTURES

(for specific determinations, see 61.55 to 61.80)

61.16D Electron microscopy determinations

Proceedings of the 21st Annual Conference of the Electron Microscopy Society of Southern Africa ....See Entry 64591

Structure of α- and β-Si_3N_4 observed by 1 MV electron microscopy ....See Entry 66968

61.20 CLASSICAL, SEMICLASSICAL, AND QUANTUM THEORIES OF LIQUID STRUCTURE

(for kinetic and transport theory, see 51.10; for electronic states, see 71.; for liquid helium, see 67.)

66787 Fluids of hard diatomic molecules. I. M.S.Wertheim (Math Dept., Rutgers Univ., New Brunswick, NJ, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4619-24 (1 April 1983).
The problem addressed is that of finding the complete orientation-dependent pair distribution function of a fluid of hard diatomic molecules. The treatment decomposes the Mayer f function into several terms and uses a graph-theoretical treatment. The basic idea is the explicit use of molecular geometry in constructing approximations. The fugacity expansion is found to be superior to the density expansion for this purpose. The neglect of large classes of graphs is shown to be exact for extremely asymmetric diatomics and is introduced as a new approximation for the less asymmetric case. Topological reduction of the reduced expansion leads to a result that resembles the density expansion, but contains an additional parameter. An integral equation of Ornstein-Zernike type is derived, and an approximation for closing the equation is suggested. The resulting equations are calculationally tractable and can be used to obtain both the centers correlation function and the higher harmonics of the pair distribution function. The relation to RAM perturbation theory is discussed briefly. (27 refs.)

66788 Fluids of hard diatomic molecules. II. M.S.Wertheim (Math. Dept., Rutgers Univ., New Brunswick, NJ, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4625-31 (1 April 1983).
For pt.I see ibid., vol.78, no.7, p.4619-24 (1982). The author considers fluids of hard diatomic molecules composed of two fused hard spheres of unequal diameter. The orientation average of the Mayer f function and the second virial coefficient B_2 are calculated exactly by analytic integration in closed form. The calculation uses a decomposition of $f(12)$ into five terms. The only difficult term is integrated in tetrahedral coordinates. Agreement with previous numerical results for B_2 is excellent. Two of the five terms make small to moderate contributions to B_2, depending on the molecular parameters. This supports the view that the decomposition is a useful device in formulating approximate theories. The integrals evaluated for the diatomic case are used to obtain B_2 and the orientation-averaged $f(12)$ exactly for a class of linear symmetric triatomic molecules. (10 refs.)

66789 The perturbation theories for the dipolar fluids. L.L.Lee, T.H.Chung (School of Chem. Engng. & Materials Sci., Univ. of Oklahoma, Norman, OK, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4712-20 (1 April 1983).
The authors derive four different perturbation equations for the calculation of the angular pair correlation functions of dipolar fluids; namely, the first order y-expansion, the modified Percus-Yevik (MPY) expansion, the modified hypernetted chain (MHNC) expansion, and the modified linearized hypernetted chain (MLHNC) equation. Both the method of the functional expansion and the method of the cluster integrals are utilized. Comparison with other perturbation theories (e.g. the Melnyk-Smith equation) is made. While none of the theories are exact, as shown by the cluster diagrams, the MLHNC and the MHNC contain more diagrams than, say, the MPY and y-expansion. The y-expansion equation can be improved by including the correction terms to the Kirkwood superposition approximation for the triplet correlation function. For example, the inclusion of the correction term $\rho\int d4h(14)h(24)h(34)$ in a formula given by Henderson (1967), is shown to improve substantially the y-expansion equation. The authors examine the performance of two of the theories: the y-expansion and the MLHNC equation for a Stockmayer (dipolar) fluid with a reduced dipole moment μ^{*2} $[=\mu^2/(\epsilon\sigma^3)]=1.0$. Comparison with Monte Carlo simulation results of Adams et al. (1981) and with other theories (e.g. the QHNC equation) shows that the authors' results are reasonable. Further improvements of the equations are also pointed out. (28 refs.)

66790 Mesoscopic kinetic theory. M.Grmela (Dept. of Chem. Engng., Ecole Polytech., Montreal, Quebec, Canada), W.G.Laidlaw.
J. Chem. Phys. (USA), vol.78, no.8, p.5151-63 (15 April 1983).
Kinetic theory is regarded as a phenomenological theory of macroscopic physical systems. The kinetic equations are constructed as continuity (Liouville) equations corresponding to the time evolution equations of a representative particle subjected to averaged, effective forces. Through the effective forces the unique character of the systems under consideration is expressed. The phenomenological kinetic theory is validated by establishing its relationship to equilibrium thermodynamics and hydrodynamics. A unified approach to the study of relations among dynamical theories formulated on different levels is proposed. (27 refs.)

66791 Mesoscopic kinetic theory of polymer melts. M.Grmela, P.J.Carreau (Dept. of Chem. Engng., Ecole Polytech., Montreal, Quebec, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.5164-74 (15 April 1983).
A novel approach to phase space kinetic theory of dense polymer systems and to the study of their equilibrium and nonequilibrium properties is proposed. Phase space kinetic equations are constructed as continuity equations of the time evolution equation of a representative dumbbell subjected to an averaged field force. A thermodynamic equation of state, an expression for the pressure tensor involving the configuration space distribution function and an equation governing the time evolution of the configuration space distribution function are obtained as three consequences of a single phase space kinetic equation. (28 refs.)

66792 The solution of the MSA for asymmetrical hard ions: the effects of the coupling parameter P_n on the shielding parameter Γ and the structure of the electrolyte solutions. L.L.Lee (School of Chem. Engng. & Materials Sci., Univ. of Oklahoma, Norman, OK, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5270-1 (15 April 1983).
It has been asserted that the value of P_n for dilute electrolyte solutions or for ions of similar sizes is small, and can be neglected in a first approximation. The author tests the validity of the approximation $P_n=0$ for concentrated solutions and ions of different diameters. The authors carried out numerical calculations for concentrated 1-1 electrolyte solutions with a range of Bjerrum lengths B from, e.g., 1 to 32. (4 refs.)

66793 Diffusion in concentrated hard sphere dispersions: effective two particle mobility tensors. I.Snook, W.van Megen (Dept. of Appl. Phys., Royal Melbourne Inst. of Technol., Melbourne, Australia), R.J.A.Tough.
J. Chem. Phys. (USA), vol.78, no.9, p.5825-36 (1 May 1983).
In view of the practical difficulties already encountered plus those anticipated in the implementation of many-body hydrodynamic interactions, the authors examine a number of empirically screened two particle mobility tensors. The empirical screening constant(s), which depend on the dispersion concentration, are adjusted to give the best agreement with available experimental mutual and local self-diffusion constants for concentrated hard sphere dispersions. These diffusion constants are obtained experimentally from the first cumulant of the coherent intermediate scattering function in the small and large wave vector limits. They find that the experimental data can only be satisfactorily reproduced by employing a pair mobility tensor containing two adjustable screening terms. The predictions of the final mobility tensor at intermediate wave vectors are also qualitatively consistent with experiments. (41 refs.)

66794 Kinetic theory of non-equilibrium fluid. E.G.D.Cohen (Rockefeller Univ., New York, NY, USA).
Physica A (Netherlands), vol.118A, no.1-3, p.17-42 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
A survey of the kinetic theory of transport phenomena in simple fluids is presented. The Chapman-Enskog solution of the Boltzmann equation for dilute gases, the Enskog theory for dense gases, and the current theory for moderately dense gases are discussed. Next, a critique of the Green-Kubo formulae for the transport coefficients is presented. After a discussion of the long time tail contributions to the transport coefficients, recent computer simulations of dense fluids under very severe strain rates or high frequencies are compared with present theory. (61 refs.)

66795 Non-equilibrium molecular dynamics calculations of the shear viscosity of hard spheres. J.J.Erpenbeck (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Physica A (Netherlands), vol.118A, no.1-3, p.144-56 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
The coefficient of shear viscosity is computed by two non-equilibrium molecular dynamics methods related to those of Lees and Edwards (1972), Evans (1979, 1980), and Ashurst and Hoover (1977) for hard sphere systems at a fluid density near the solid transition density. One of the methods is isothermal in that it arbitrarily rescales the peculiar velocities. The other permits the system to heat with time. The resulting viscosities are found to agree within the statistical uncertainties for all values of the shear rate studied. Moreover, the non-equilibrium results would appear to be consistent with the zero-shear-rate Green-Kubo results. However, the calculated viscosity shows no evidence for a square-root dependence on shear rate, within the rather large statistical uncertainties, particularly at small shear rate. Moreover, if one deduces a square-root dependence from the previously observed long-time tail of the shear viscosity through the Zwanzig (1981) relation, then these viscosities appear to disagree significantly. (17 refs.)

66796 Linear and nonlinear response in computer simulation experiments [fluid]. G.Jacucci (Phys. Dept., Univ. of Trento, Trento, Italy).
Physica A (Netherlands), vol.118A, no.1-3, p.157-65 (March 1983). (Proceedings of the Conference on Nonlinear Fluid Behavior, Boulder, CO, USA, 7-11 June 1982).
Computer simulation experiments on transport properties using perturbation of mechanical trajectories are critically discussed in the light of Van Kampen's (1971) 'case against linear response theory' and of the numerical experiments in the nonlinear region of Visscher (1974), and more recently of Evans (1981). (6 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior ....See Entry 64582

Configurational entropy of mixtures of molecules having different shapes ....See Entry 64874

On the MCY potential for liquid water ....See Entry 66797

Liquid structure of ammonia—a case of Apollo model of orientation for pyramidal molecules ....See Entry 66805

Corrected Debye-Huckel theory of electrolyte solutions ....See Entry 67238

Thermodynamic properties of a square-well fluid in the liquid and vapor regions ....See Entry 67239

Theoretical results for aqueous electrolytes. Ion-ion potentials of mean force and the solute-dependent dielectric constant ....See Entry 68105

61.25 STUDIES OF SPECIFIC LIQUID STRUCTURES

(see also 61.40 Amorphous and polymeric materials)

66797 On the MCY potential for liquid water. D.G.Bounds (Theoretical Chem. Dept., Univ. of Oxford, Oxford, England).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.604-6 (22 April 1983).
The fit of the MCY potential to the CI energies of water dimers calculated by Matsuoka, Clementi and Yoshimine (J. Chem. Phys., vol.64, p.1351, 1976) is examined. The MCY potential shows systematic deviations from the data points in all ten directions of approach considered in the earlier calculation. A new fit is given which is much closer to the CI energies. Molecular dynamics simulations show that the original CI data lead to a poorer liquid structure than the MCY fit suggests. (10 refs.)

66798 Chloro-complexes formation in a $ZnCl_2$-$CdCl_2$ aqueous solution: an X-ray diffraction study. G.Paschina, G.Piccaluga, G.Pinna (Istituto Chimica Fisica e Industriale, Univ. di Cagliari, Cagliari, Italy), M.Magini.
J. Chem. Phys. (USA), vol.78, no.9, p.5745-9 (1 May 1983).
A solution containing 1 mol/*l* of $ZnCl_2$ and $CdCl_2$ was examined by X-ray diffraction in order to study the mean environments of the two cations. The results were compared with those obtained from two solutions in which the same salts were separately dissolved Zn^{2+} ions turned out to be hexa-coordinated both in the single and the mixed solution, the coordination shell being composed of about five water molecules and one Cl^- ion. On the other hand, Cd^{2+} ions, which in the $CdCl_2$ solution are nearly hexa-coordinated, become tetracoordinated, in the mixed solution. This transition is accompanied by a significant increase of the Cd^{2+}-Cl-complexation degree. (27 refs.)

66799 Thermodynamic perturbation theory for molecular liquid mixtures. J.Fischer, S.Lago (Inst. fur Thermo- und Fluiddynamik, Ruhr-Univ., Bochum, Germany).
J. Chem. Phys. (USA), vol.78, no.9, p.5750-8 (1 May 1983).
A weeks-Chandler-Andersen type (1971) perturbation theory for the Helmholtz energy of mixtures consisting of molecules with nonspherical cores is given. The correlation functions are obtained from a reference mixture of softly repulsive spherical particles. For that mixture the Percus-Yevick equation is solved with Baxter's formalism. By a blip expansion a hard convex body system is determined for which the free energy is obtained from Boublik's equation. For one-center Lennard-Jones liquids, the excess properties for mixtures agree with simulation results as good as those of the Baker-Henderson (1976) and the variational theory, while the pure substance properties are obtained better now. For mixtures of one-center and two-center Lennard-Jones liquids, the excess volumes and the excess enthalpies are given for argon/nitrogen and argon/oxygen after fitting the unlike pair interaction to the experimental value of the excess Gibbs energy. The results resemble those obtained from simpler theories, but discrepancies with reported experimental data remain. (44 refs.)

66800 HNC solution for the central force model for liquid water. R.A.Thuraisingham, H.L.Friedman (Dept. of Chem., State Univ. of New York, Stony Brook, NY, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5772-5 (1 May 1983).
Beginning with the central force model for water introduced by Lemberg, Stillinger, and Rahman (1975), the HNC approximation method has been used to calculate the atom-atom pair correlation functions of a state of liquid water. Although a stable and accurate solution to the HNC equation for the model is obtained using the Rossky-Dale algorithm, the structure and thermodynamics agree only crudely with the published molecular dynamics results for the same model and the same N, V, T state. (25 refs.)

66801 Ab initio interatomic potential curves for $NaNO_2$ and the simulation of the molten salt. J.D.Goddard, M.L.Klein, Y.Ozaki (Chem. Div., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1168-72 (April 1983).
Ab initio potential energy curves are presented for $(Na^+)(NO_2^-)$ as a function of the Na-N separation. The minimum energy configuration is similar to that observed in the room temperature ferroelectric solid. Empirical atom-atom potential energy functions based in part on the ab initio calculations, are used in a molecular dynamics computer simulation of the molten salt.

66802 A group interaction model for liquids. Application to liquid n-alkanes and n-alkane+n-alkane liquid mixtures. V.Perez Villar, R.Bravo, M.I.Paz Andrade (Dept. de Fisica Fundamental, Univ. de Santiago de Compostela, Santiago de Compostela, Spain).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.2, p.225-32 (Feb. 1983).
Based on Flory's ideas about functional groups, a statistical model for liquids has been developed. This model is characterised by some parameters permitting an adequate description of the properties both of the pure liquids as well as their mixtures. The results obtained by applying this model to systems composed of n-alkanes and their mixtures show a reasonably good agreement with experimental data for volumes, thermal expansion coefficients and thermal pressure coefficients, as functions of temperature. (19 refs.)

66803 A qualitative analysis of the radial distribution functions of water on the basis of the model of a continuous random tetrahedrally coordinated network. V.I.Korsunskii, Yu.I.Naberukhin (Inst. of Chem. Kinetics & Combustion, Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.400-7 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.92-100 (May-June 1982). [received: Feb. 1983]
The radial distribution functions (RDF) of water at temperatures in the range 4-200°C, obtained using procedures which eliminate the basic errors of the numerical Fourier transformation, have been given. A significant improvement in the quality of the RDF in the range of the large intermolecular distances has been achieved. It follows from an analysis of the RDF that the structure of water at all temperature represents a continuous random four-coordinated network of hydrogen-bonded molecules. At low temperatures, the main role in the production of the structure of the network and the form of the RDF is played by the directed character of the H-bonds (on the average tetrahedral coordination of water molecules) and the formation of rings of connected molecules. At temperatures above 100°C, the directed character of the bonds and the molecules. At temperatures above 100°C, the directed character of the bonds and the tetrahedral coordination disappear as a result of very large deviations from linear geometry of the H-bonds, but, as at low temperatures, each molecule is joined to four nearest neighbors. (26 refs.)

66804 Anisotropic solutions of methylol cellulose. P.A.Patton, R.D.Gilbert (Dept. of Textile Chemistry., North Carolina Univ., Raleigh, NC, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.515-22 (April 1983).
Methylol cellulose solutions in dimethylsulfoxide exhibit a viscosity maximum at 18% w/v followed by a minimum at 20%, as is characteristic of lyotropic liquid crystals. The biphasic solutions exhibit areas of clear and cloudy appearance. The latter are birefringent. The highly anisotropic solutions are uniformly birefringent and in the 25-33% w/v concentration region they are brightly coloured. The optical rotations of the mesomorphic phases are high, indicating a cholesteric structure. The sign of the optical rotation depends on the solution concentration and at high concentrations (25+% w/v) varies with the area of the solution viewed. (11 refs.)

66805 Liquid structure of ammonia—a case of Apollo model of orientation for pyramidal molecules. R.V.Gopala Rao, B.M.Satpathy (Phys. Chem. Section, Jadavpur Univ., Calcutta, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.599-605 (Nov. 1982). [received: April 1983]
The Apollo model of Egelstaff et al. (1971) for the orientation of tetrahedral AB_4 type molecules has been extended to study the liquid structure of AB_3 type pyramidal molecules like ammonia. With a suitable choice of diameter to calculate the centre structure function through a hard sphere potential, the molecular structure function has been evaluated and compared with experimental X-ray diffraction results. From the experimental molecular structure function, the intermolecular angle-averaged potential and other centre correlation functions have been evaluated. (17 refs.)

Proceedings of the Conference on Nonlinear Fluid Behavior ....See Entry 64582

Structural investigation of molten and glassy silicates by means of infrared emission spectrometry ....See Entry 66886

Effect of ethanol on the conductivity of supercooled aqueous potassium chloride solutions ....See Entry 67251

Viscosity properties of solutions of polyvinylbutyl ether of atactic and isoatactic structure ....See Entry 67256

Pre-vitrification viscosity enhancement by longitudinal mode coupling ....See Entry 67259

The contribution of hydrogen bonds to the surface tension of water ....See Entry 67308

Deuterium relaxation of a partially oriented methyl group. III. Order director fluctuations and solute reorientation in a nematic solution of acetonitrile-d_3 ....See Entry 68060

Experimental and theoretical approach to molecular dynamics of pyridine derivatives and related molecules from dielectric relaxation measurements. I. 2.3′-bipyridyl in the liquid state ....See Entry 68122

Characters of local dynamics and local structure inferred from far infra red spectroscopy ....See Entry 68192

The OH stretching spectrum of liquid water: a random network model interpretation ....See Entry 68196

Raman and visible-ultraviolet spectra of polyhalide anions in molten I_2/KI-LiI, I_2/CsCl-LiCl, and I_2-ICl/CsCl-LiCl ....See Entry 68199

61.25M Liquid metals

66806 Temperature dependence of the structure factor of liquid metals. R.N.Joarder (Dept. of Phys., Jadavpur Univ., Calcutta, India), R.V.Gopala Rao.
Phys. Status Solidi b (Germany), vol.116, no.1, p.299-306 (1 March 1983).
An expression for temperature dependent packing density is obtained and it is shown that this temperature dependent packing density can account the temperature dependence of structure factor, self-diffusion coefficient, and shear viscosity with good accuracy. Other observations at higher temperatures also confirm this procedure. (25 refs.)

66807 Possible existence of liquids in an anticrystalline structural state. V.I.Psarev, A.L.Ivanov (I.N. Ul'yanov Chuvash State Univ., USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.706-10 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.31-5 (Aug. 1982). [received: April 1983]
The character of crystallization and transition into an amorphous state of alloys based on tellurium with the elements Ge, Si, Al, In, Ga indicates the existence of an interrelationship between the internal structure of the fused alloy and the crystalline structure which develops upon solidification. The observed crystalline effects considered together with the peculiarities of metastable phase formation in alloys of other systems indicates the insufficiency of present concepts of the cluster structure of liquids. A new description of the most probable structural state of a liquid will be formulated on the basis of experimental data. (11 refs.)

66808 Structure of molten Bi-Zn-alloys by means of neutron diffraction. W.Knoll, P.Lamparter, S.Steeb (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.395-8 (April 1983).
Neutron diffraction experiments were performed with five molten Bi-Zn-alloys and the two molten elements Bi and Zn. The total structure factors and the pair correlation functions are given. The concentration dependence of the experimental nearest neighbour distances and the experimental coordination numbers is in accordance with the segregation behaviour prevailing in these melts. (16 refs.)

Ultrasonic investigation of interactions in mercury ....See Entry 67109

A pseudoatom theory for the liquid-vapor interface of simple metals: computer simulation studies of sodium and cesium ....See Entry 67179

61.30 LIQUID CRYSTALS

(see also 64.70M Transitions in liquid crystals)

66809 Temperature dependence of liquid crystal tilt angles. H.A.van Sprang, R.G.Aartsen (Philips Res. Labs., Eindhoven, Netherlands).
Appl. Phys. Lett. (USA), vol.42, no.8, p.669-71 (15 April 1983).
In a homogeneous cell the origin in the steep decrease, which is always observed in the liquid crystal tilt angle on an SiO_x coating as a function of temperature in the range close to T_c, is traced back to the growth of twist domains. It appears that a magnetic null method is unsuited for accurate tilt angle measurements in the relevant temperature region, because it is based on the assumption of a homogeneous director pattern in the sample cell. (13 refs.)

66810 Binary smectic mixtures in the infinite dilution limit. W.Wagner (Akad. der Wissenschaften, Zentralinst. fur Elektronenphys., Berlin, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.K35-7 (1983).
The authors extend the well-known McMillan theory of the smectic A phase to investigate binary mixtures. They also investigate the nematic-smectic A transition and investigate the possibility of phase separation. (6 refs.)

66811 Studies on induced smectic phases. III. Fourier transform infrared and laser-Raman spectral differences between isotropic and induced smectic phase of binary mixtures of nematogens with contrasting dielectric anisotropies. J.Szabon (Central Res. Inst. for Phys., Budapest, Hungary), W.Pilz, H.D.Koswig.
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.519-25 (1983).
The S_E, S_B, S_A induced phase sequence was detected in binary mixtures of two nematogens, 4,4′-di-n-heptyl azobenzene (7 AB) with 4-n-pentyl-4′-cyano biphenyl (5CB). The mixtures as well as the single components were studied by Fourier transform IR and laser-Raman spectroscopy at different temperatures. Charge redistribution of 5CB is demonstrated by the spectral differences found by the ratio-recorded IR spectra and also by integrating the intensities of some Raman lines. The spectra of the different phases of the 7AB-5CB mixture, built up from components of different length, indicate a population increase of the gauche conformers of 7AB in the smectic A phase. (9 refs.)

66812 Dielectric investigations in liquid crystalline substances with elongated lateral groups. H.Kresse, M.Keil, W.Weissflog (Sektion Chem., Martin-Luther-Univ., Halle-Wittenberg, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.563-7 (1983).
By the aid of dielectric measurements (dipole moments, static dielectric constants, dielectric absorption) the influence of the chemical structure of a lateral group on the dielectric behaviour has been investigated. From the experimental data it can be deduced that the lateral group rotates independently. (7 refs.)

66813 The contrast gain in a guest-host nematic display due to a periodic boundary condition. G.Barbero (Dipartimento di Fisica, Univ. di Calabria, Calabria, Italy), A.Strigazzi.
Appl. Phys. A (Germany), vol.A31, no.1, p.55-7 (May 1983).
The mean square tilt angle of a nematic slab with finite anchoring energy and periodic boundary conditions has been theoretically investigated, as a

function of the slab geometry and of the reduced extrapolation length. If the anchoring strength is free-surface-like, the contrast is affected by a loss $\gtrsim 10\%$ at room temperature if the ratio between the anchoring pitch and the cell thickness is $\gtrsim 0.5$. (27 refs.)

66814 Surface twist disclination in nematics on ferroelectric TGS. L.Lejcek (Inst. of Phys., Czechoslovak Acad. Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.447-4 (1983).
The core structure of twist disclination in MBBA above the domain wall in ferroelectric TGS with positive and negative polarization is investigated using the Peierls-Nabarro model. The lowest limit of the surface anchoring energies of negatively and positively polarized domains is estimated using the experimentally determined width of disclination. A similar estimate of the surface anchoring energy of paraelectric TGS is also made. (16 refs.)

66815 Landau-type theory applied to mixtures of liquid crystals of opposite diamagnetic anisotropies. K.P.Sinha, R.Subburam (Indian Inst. of Sci., Bangalore, India), C.L.Khetrapal.
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.472-4 (15 April 1983).
An application of Landau-type theory to interpret the orientation of mixed liquid crystals of opposite diamagnetic anisotropies has been made. Experimental NMR results on three systems containing benzene and acetonitrile as the probe molecules have been interpreted. The computed order parameters are in agreement with those obtained experimentally in several systems. The switching transition at a critical concentration and temperature and the coexistence of two types of orientations have been explained. (5 refs.)

66816 Dielectric anisotropy in 4-nitrophenyl 4′-octyloxybenzoate. R.A.Yadav (Appl. Sci. Dept., M.M.M. Engng. Coll., Gorakhpur, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.999-1000 (Dec. 1982). [received: April 1983]
The temperature variation of the static dielectric constants ($\epsilon_\parallel$ and $\epsilon_\perp$) of 4-nitrophenyl 4′-octyloxybenzoate has been investigated in isotropic, nematic and smectic-A phases under the influence of sufficient magnetic field acting parallel and perpendicular to the symmetry axis of the molecule. Steps have been found in both $\epsilon_\parallel$ and $\epsilon_\perp$ as well as in the dielectric anisotropy (ϵ_a) at the nematic-smectic-A phase transition. This effect is interpreted as due to the increase of the number of pairs of antiparallel dipoles at the phase transition. (10 refs.)

66817 Thermal generation of confocal domains in a smectic A liquid crystal. N.J.Chou, S.W.Depp, J.M.Eldridge, M.H.Lee, G.J.Sprokel, A.Juliana, J.Brown (IBM Res. Lab., San Jose, CA, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1827-32 (April 1983).
The effects of vacuum-deposited SiO_x alignment layers on the thermal generation of focal conic centers in a smectic A liquid crystal were investigated using controlled thermal cycles. Surface defects were found to promote focal conic formation. Focal conic density increases with cooling rate for a given alignment layer, and with the deposition angle of the alignment layer for a fixed cooling rate. An attempt was made to fit these findings to hetrogeneous nucleation theory in an effort to better understand the effects of selected thermodynamic properties on the focal conic formation process. (24 refs.)

66818 Smectic behavior and molecular structure: on the mesomorphism of a series of hydrocarbons. W.H.de Jeu (Solid State Phys. Lab., Groningen, Netherlands), R.Eidenschink.
J. Chem. Phys. (USA), vol.78, no.7, p.4637-40 (1 April 1983).
The polymorphism is discussed of a series of hydrocarbons that show, besides a smectic-A phase, a strong tendency towards the formation of smectic-B. The powder X-ray diffraction patterns show at large Bragg angles an unusual double reflection with a very small separation, which indicates a *3D* hexagonal closed packing. It is shown that, quite generally, nonpolar molecules form orthogonal smectic phases. The implications are discussed for the relationship between molecular structure and smectic behavior. (29 refs.)

66819 Proton Zeeman and dipolar relaxation study of the ferroelectric liquid crystal DOBAMBC. R.Y.Dong, J.Sandeman (Dept. of Phys. & Astron., Brandon Univ., Brandon, Manitoba, Canada).
J. Chem. Phys. (USA), vol.78, no.7, p.4649-53 (1 April 1983).
The proton Zeeman spin-lattice relaxation time T_1 and the proton dipolar spin-lattice relaxation time T_{1D} of a chiral compound *p*-decyloxybenzylidene *p′*-amino-2-methyl butyl cinnamate are studied as a function of temperature and sample rotation in a magnetic field at 30 MHz. In addition, proton T_1 is measured in the smectic *A*, ferroelectric smectic C^* and H^* phase at 15.1 and 45.5 MHz. The spin relaxation mechanism for the proton T_1 and T_{1D} in the smectic *A* and C^* phase are 'diffusion-induced' orientational order director fluctuations and molecular self-diffusion. In contrast with the achiral compound TBBA, the T_1 angular dependence in the smectic C^* and *C* phase are different, while the T_{1D} angular dependence appears to be similar in these smectic phases. (18 refs.)

66820 Critical thickness of a hybrid aligned nematic liquid crystal cell. G.Barbero, R.Barberi (Dept. of Phys., Calabria Univ., Rende, Italy).
J. Phys. (France), vol.44, no.5, p.609-16 (May 1983).
The authors discuss the director deformation inside a hybrid aligned nematic (HAN) cell, assuming that the surface interaction is of the $(w/2)\sin^2(\phi-\Phi)$ kind, and they suppose that the anchoring energy for homeotropic alignment is greater than the planar one. In the absence of an external electric field, they show that a critical thickness d_c, below which the nematic liquid crystal (NLC) is undistorted, exists. Furthermore they investigate theoretically d_c vs. the reduced electric field (E/E_c, where E_c is a threshold field depending upon the anchoring energies and the intrinsic constants of the NLC). The last analysis shows that there are two critical thicknesses $d_c^{(H)}$ and $d_c^{(P)}$: for $d<d_c^{(H)}$ the sample is homeotropic (HOM), while for $d>d_c^{(P)}$ it is planar (PLAN). Finally they point out that if the anchoring energies are the same on the upper and lower plates of the sample, the HAN-configuration is realizable only if $E/E_c<1$. (20 refs.)

66821 Two new mesophases in a chiral compound. A.M.Levelut, C.Germain, P.Keller, L.Liebert (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France), J.Billard.
J. Phys. (France), vol.44, no.5, p.623-9 (May 1983).
Microscopical, miscibility and X-ray studies establish the existence of two new mesophases in the two enantiometers of 1 (methyl)-heptyl terephthalidene bis amino cinnamate. In one of this two mesophases the two enantiometers do not exhibit a total miscibility range; while for the second the untwisted form observed with the racemic mixture has a higher temperature range of stability than the twisted form observed for the pure enantiometers. Information about the structures of the two phases is given and a comparison is made with the S_C* and S_D phases. Nevertheless the location of these two phases in the sequence of the presently known calamitic mesophases is not yet completely established. (17 refs.)

66822 Growth of cubic liquid single crystals in cholesteric blue phases. H.Onusseit, H.Stegemeyer (Dept. of Phys. Chem., Univ. Paderborn, Paderborn, Germany).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.409-11 (March 1983).
The growth of liquid single crystals of cholesteric 'Blue Phases' has been studied by polarizing microscopy. Using extremely small cooling rates, single crystals of quadratic shape have been obtained. This habit is interpreted as being due to a cubic symmetry of the molecular long axes orientation. Possible space groups are discussed. (15 refs.)

66823 Molecular field theory of nematics: density functional approach. I. Bulk effects. T.J.Sluckin (Faculty of Math. Studies, Univ. of Southampton, Southampton, England), P.Shukla.
J. Phys. A (GB), vol.16, no.7, p.1539-53 (11 May 1983).
The molecular field theory of nematics is rephrased in density functional language. The free energy in the nematic state is expressed as a functional expansion around the isotropic state in powers of the nematic order parameters $\bar{P}_l$ and the fractional density change η at the isotropic-nematic transition. The crucial quantities in the expansion are spherical harmonics of the direct correlation functions in the isotropic state. Sensible approximations to these direct correlation functions lead to other well known formulations of nematic field theory. An exact (in the authors' approximation) result for η is obtained in terms of the potential parameters U_l and the order parameters $\bar{P}_l$ at the phase transition. The authors discuss the relationship of their approach to other microscopic theories of nematics. The theory can be extended to discuss inhomogeneous systems. (32 refs.)

66824 An analysis of thermal instabilities in obliquely aligned layers of a nematic liquid crystal. P.J.Barratt, J.S.Bramley (Dept. of Math., Univ. of Strathclyde, Glasgow, Scotland).
J. Non-Equilibrium Thermodyn. (Germany), vol.7, no.6, p.371-88 (1982).
An analysis of continuum theory, this paper investigates the occurrence of stationary and oscillatory convective instabilities when a 'comparatively thick' horizontal layer of nematic liquid crystal is subjected to a vertical temperature gradient, the director being uniformly obliquely aligned at the boundaries. Two distinct types of roll instability are considered, one being independent of the direction in these planes. To obtain accurate numerical values for the threshold gradients, the authors use Chebyshev polynomial expansions. The variation of the critical temperature gradients for both types of instability with the field strength of a uniform magnetic field applied parallel to the initial alignment and with the boundary alignment itself is investigated. (24 refs.)

66825 Flexoelectric effect in MBBA in strong electric fields. V.A.Grigor'ev, Zh.Zhelkobaev, A.V.Kaznacheev, V.I.Kukhtevich, A.S.Sonin (All-Union Sci.-Res. Inst. of Optophys. Measurements, Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1801-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3174-6 (Oct. 1982). [received: April 1983]
It has been established that the application of a transverse electric field to a homeotropic layer of MBBA causes a flexoelectric strain, which gives rise to an optical path difference Δl induced by the field E, with $\Delta l \sim E^2$. The authors attempt to detect the quadratic electrooptic effect in the nematic phase of MBBA. For this they used the interferometric technique for measuring the phase characteristics of liquid crystals described by Akimov et al. (1978). (4 refs.)

66826 Features of the behavior of a ferroelectric liquid crystal in alternating fields. D.F.Aliev, M.A.Aslanov, M.V.Loseva, N.I.Chernova (S.M. Kirov State Univ., Baku, Azerbaidzhan SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1804-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3179-81 (Oct. 1982). [received: April 1983]
The authors establish how the threshold voltages for the electrooptic effects realized in ferroelectric liquid crystals depend on the number of the member of a homogeneous series and make a detailed study of the nature of the modulation of light by a multidomain texture of the sample. In the measurements they have used a sandwich cell with a thickness of the liquid-crystal layer of 20 μ. The object of study was the homologous series of the salicylideanilines, which have a ferroelectric phase S_c^* over a rather wide range of temperatures. (10 refs.)

66827 Topological point singularities in A-smectics. M.V.Kurik, O.D.Lavrentovich.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.452-5 (March 1983). In Russian.
The polarised microscopy method was used for an experimental investigation of textures in drops of A-type smectic liquid crystals for controlled boundary conditions (tangential and normal) and for various drop shapes. It is shown that in drops with normal boundary conditions it is possible for topological point defects with indexes q=1 and q=$^1/_2$ to exist. For tangential boundary conditions, point defects were not observed. (8 refs.) *V.G.P.*

Thermal diffusivity in mesophases: a systematic study in 4-4′-di-(*n*-alkoxy) azoxy benzenes .... See Entry 66559

Anisotropic solutions of methylol cellulose .... See Entry 66804

Anisotropy of molecular oscillations as a factor in forming partially ordered structures .... See Entry 67152

The polymorphism of 2-n-Nonyl-5-[4-n-butyloxyphenyl]-pyridine .... See Entry 67204

On the rectangular-hexagonal columnar phase transition in disc-like liquid crystals .... See Entry 67205

Macroscopic dynamics in nematics near the uniaxial-biaxial phase transition .... See Entry 67206

Change in molecular conformation and the nature of the nematic-isotropic-liquid phase transition .... See Entry 67208

On the cholesteric-nematic phase-change transitions in layers with homeotropically orienting surfaces .... See Entry 67209

Self-diffusion coefficient of nematic liquid crystals from diffusion concentration gradient .... See Entry 67253

Proton NMR investigations of the smectic-C phases of three alkyloxy-azoxybenzenes .... See Entry 68055

Dielectric relaxation and Freedericksz effect .... See Entry 68116

Ultrasonic switching of a bistable liquid crystal cell .... See Entry 68171

61.40 AMORPHOUS AND POLYMERIC MATERIALS

(see also 64.70P Glass transitions 81.20P to 81.20T, and 81.60 Materials science)

66828 Investigation of structure relaxation in Co-Ni-Fe base metal glasses by X-ray scattering. Zhao Ji-liang, Luo Yuan-su, Huang Sheng-tao (Dept. of Phys., Wuhan Univ., Wuhan, China).
Acta Phys. Sin. (China), vol.32, no.1, p.15-24 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The effects of isothermal and isochronal annealing on the structures of the metal glasses $Co_{50.7}Ni_{19.5}Fe_{7.8}Si_6B_{16}$ and $Co_{42.9}Ni_{27.3}Fe_{7.8}Si_8B_{14}$ have been investigated by the wide angle and the small angle X-ray scattering methods. The experimental results obtained show two types of structure relaxation: The relaxation associated with topographical short range ordering (TSRO) and the relaxation associated with chemical short range ordering (CSRO), and give particularly the direct evidence of the CSRO relaxation process in the amorphous states. The atomic co-operative process of the two types of structure relaxation, and their coexistence and correlation are discussed preliminarily. (18 refs.)

66829 X-ray diffraction study of short-range order in a disordered Au_3Cu alloy. M.Bessiere, S.Lefebvre, Y.Calvayrac (CECM, Vitry-sur-Seine, France).
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.145-53 (1 April 1983).
The X-ray diffuse scattering from an Au_3Cu single crystal rapidly cooled from 485K is quantitatively measured both at room temperature and at 80K. Different methods for correcting from temperature diffuse scattering are used: extrapolation to 0K, calculation of thermal diffuse scattering [Walker and Chipman (1970), Acta Cryst. A26, 447-55], data analysis with the Borie-Sparks method [Borie and Sparks (1971), Acta Cryst. A27, 198-201] and with the improvement proposed by Hayakawa, Bardhan and Cohen (J. Appl. Cryst. (1975), 8, 87-95]. As in earlier electron diffraction studies [Watanabe and Fischer (1965). J. Phys. Soc, Jpn, 20, 2170-9], a fourfold splitting of the diffuse intensity is observed at 100, 110 and equivalent positions in reciprocal space. A recalculated short-range-order intensity map shows that long-range two-site correlation functions are essential in order to fit the experimental data. (37 refs.)

66830 Local structure of δ-FeOOH. G.Patrat, F.de Bergevin, M.Pernet, J.C.Joubert (Lab. de Cristallographie, CNRS, Grenoble, France).
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.165-70 (1 April 1983).
Short-range order between 50% vacancies (□) and 50% Fe on the Fe sites has been studied in the disordered compound iron hydrogenperoxide, δ-FeOOH, using powder X-ray diffuse scattering techniques. A preliminary treatment of the intensity was made in which the two Fe sites were considered as equivalent. Two conclusions were deduced: along the **c** axis. Fe cations can be nearest neighbours but their distance is 16% larger than the mean value obtained with the mean structure; along the **c** axis, the periodicity is Fe□Fe□... on the sites separated by 4.56 Å. In a more accurate treatment the two Fe sites have been considered separately. (6 refs.)

66831 Structure analysis of the disordered cubic phase of rubidium cyanide. K.-D.Ehrhardt, W.Press (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany), G.Heger.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.171-5 (1 April 1983).
With neutron diffraction the orientational distribution of the CN^- group in the disordered cubic phase of RbCN is investigated at two different temperatures. The description of the orientational distribution functions includes a coupling between rotational and translational degrees of freedom. The influence of the thermal diffuse scattering is discussed. The results are compared with the findings in KCN and NaCN. (22 refs.)

66832 Conditions for the preparation and subsequent crystallization of amorphous alloys of the Ge-Te system. V.I.Psarev, A.L.Ivanov, T.Yu.Vtorkina, M.Yu.Fedorov (I.N. Ul'yanov Chuvash State Univ., Chuvash, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.789-92 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.942-5 (June 1982). [received: Feb. 1983]
The peculiarities of the formation and subsequent crystallization of amorphous tellurium-germanium alloys containing 3.5 to 30.5 at.% Ge were investigated. The fundamental possibility of obtaining amorphous states in the case of relatively slow and quiet cooling of superheated melts was shown in the case of these alloys. The minimum cooling rate should be applied to the melt with the eutectic composition. A change in the internal structure of the melts during their heating and cooling in the precrystallization range of temperatures that is accompanied by a reversible thermal effect at 390-400°C was observed. Crystallization of the post-eutectic, eutectic, and pre-eutectic amorphous alloys is a multistep process and has its own characteristic features in each case. The first step in the crystallization of post-eutectic amorphous alloys is characterized by the segregation of monoclinic tellurium, which is converged to hexagonal tellurium only in the subsequent steps of the transformations. In the crystallization of amorphous alloys with eutectic and pre-eutectic compositions hexagonal tellurium is formed immediately in the first step, after which the Te+GeTe eutectic is formed. (7 refs.)

66833 Structural features of amorphous and crystalline red phosphorus. V.V.Makarenko, N.D.Talanov, S.B.Kapilevich, L.M.Melikyants (Ya.V. Samoilov Sci.-Res. Inst. for Fertilizers, Insecticides & Fungicides, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.918-20 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1083-6 (July 1982). [received: Feb. 1983]
By means of electron microscopy, mercury porosimetry, and gas adsorption, the authors have investigated the structural features of amorphous and crystalline red phosphorus. Their specific surface areas and pore volumes have been determined. The amorphous red phosphorus has been shown to contain closed pores. As a consequence, the amorphous red phosphorus is comparatively resistant to oxidation by atmospheric oxygen, in comparison with the crystalline red phosphorus. (10 refs.)

66834 Bond length measurements in amorphous solids by nutation NMR spectroscopy: the role of RF field homogeneity. D.Horne, R.D.Kendrick, C.S.Yannoni (IBM Res. Lab., San Jose, CA, USA).
J. Magn. Resonance (USA), vol.52, no.2, p.299-304 (April 1983).
It is possible to measure internuclear distances in amorphous solids from homonuclear dipolar splittings obtained using nutation NMR spectroscopy. These splittings, manifest as the maxima in a Pake powder pattern are normally masked or distorted by chemical shift effects in the spectrum obtained from a free decay but emerge clearly in the Fourier transform of a transient nutation excited by the sudden and continuous application of a resonant RF field. The note underlines the importance of RF field homogeneity in nutation NMR experiments, and illustrates the improvement in resolution gained by using an RF coil designed to produce a more uniform RF field distribution. The spectra presented show that with this improvement, carbon-carbon bond lengths in amorphous solids can be measured with 1% accuracy. (10 refs.)

66835 Intrinsic limitations of diffraction methods for the study of noncrystalline structures. A.Guinier (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.1-5 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The diffraction methods determine completely the structure of crystals, because the matter is ordered. In the case of amorphous substances, the possibilities of diffraction have limitations that improved technics cannot overcome. In that case, hypothetic structural models may be very useful. (no refs.)

66836 New methods of studying disordered solids. J.D.Mackenzie, J.Lau (Dept. of Materials Sci. & Engng., Univ. of California, Los Angeles, CA, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.7-16 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
In the past five years or so, many new methods have been used to elucidate the different aspects of the structure of disordered solids such as local structure, long-range structure, microstructure, and defect structure. Simultaneously, many new disordered solids have been prepared and hence the number of unsolved problems are in a sense undiminished. In addition, new tools have been utilized to gain understanding of some important properties of disordered solids. Despite the many new techniques and approaches, much remains uncertain both with respect to structure and to properties. The recent positive contributions of new methods are critically reviewed and some continuing challenges discussed. (64 refs.)

66837 The structure and the medium range order in thin amorphous germanium films prepared in UHV. P.Viscor (Univ. de l'Etat, Mons, Belgium).
J. Phys. Colloq. (France), vol.43, no.C-9, p.39-42 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Stable amorphous germanium (a-Ge) films were prepared by slow evaporation onto heated sapphire substrates in ultrahigh vacuum (UHV). The structure of these films was investigated by in-situ transmission high energy electron elastic diffraction performed at 77K, by in-situ density measurements and by in-situ determination of the low energy refractive index. The density and the refractive index measurements indicated that thin, stable a-Ge films are appreciably less dense than the crystaline counterpart. The low temperature electron diffraction experiments showed some changes in the positions of the reciprocal space interference maxima, when compared with work of others. Also for the first time, a 'sharp' diffraction pre-peak (at $s=1.2$ $Å^{-1}$) has been observed, a diffraction feature generally seen in disordered systems. The results are discussed in terms of the coordination and the range of the electronic bonding interactions in glass. (10 refs.)

66838 Structures of amorphous materials and specific volume variations versus the temperature. J.F.Sadoc, R.Mosseri (Phys. des Solides, Univ. Paul Sabatier, Orsay, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.97-100 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A systematic structural description of amorphous materials is presented and used, to explain the variation of the specific volume of amorphous (or glassy) compounds versus temperature. (14 refs.)

66839 Amorphization of silicon oxynitride irradiated with fast neutrons; study by infrared spectrometry. M.I.Baraton, P.Quintard (Lab. de Phys. Moleculaire, Limoges, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.127-30 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Reports measurements of the infrared absorption in fast neutron irradiated Si_2ON_2, correlated with the kinds of damage induced in the crystal cell. First the authors have assigned all observed absorption bands of the spectrum and obtained the integrated intensity for the fresh and irradiated material, then they have clearly shown a break in silicon-oxygen bond and variations in the nearest structures. These point defects precede a progressive amorphization of the bulk. (10 refs.)

66840 Crystallisation of noncrystalline solids in the system $Li_2B_2O_4$-$LiFe_5O_8$. C.Chaumont, J.C.Bernier (Dept. Sci. des Materiaux, CNRS, CENSCS, Strasbourg, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.215-18 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
In the system $Li_2B_2O_4$ (100-x)-$LiFe_5O_8$x (0,1<x<15%) amorphous compounds prepared by ultrafast quenching methods are metastable and crystallize by annealing. The crystallization scheme found for $Li_2B_2O_4$90-$LiFe_5O_8$10 is extended to all the system. Anomalies observed for the glass temperatures T_G are interpreted with the diagram Volume/Temperature/State of the system. They are due to the discrepancies in respect to perfect glass and can be studied by differential scanning calorimetry (DSC or DTA). (6 refs.)

66841 Defects in Fe_7C_3 type carbide formed during the crystallisation of amorphous high carbon alloys and their relation with the amorphous state. E.Bauer-Grosse, J.P.Morniroli, C.Frantz, G.Le Caer (Lab. de Metallurgie, Ecole Nat. Superieure de la Metall., Industrie des Mines, Nancy, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.285-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
M_7C_3 type carbides have an orthorhombic structure, as proposed by R. Fruchart et al. (1970). This structure may be hidden by defects which are typical of the preparation method. In Fe_7C_3 formed by crystallization of sputter-deposited amorphous $Fe_{75}C_{25}$ alloys, the defects are only consistent with elongated domains whose size is less than ~100 Å, the order of the defect size. In primary M_7C_3 carbides, present in white cast-iron and chromium steels, domains are about 100 times larger than in the latter case. Both results suggest that domain growth is impeded during the crystallization of amorphous $Fe_{75}C_{25}$. Nuclei may thus already exist in or be easily deformed with a large density from the amorphous state. The formation of Fe_7C_3 is discussed within the frame of the Gaskell model (1979). (12 refs.)

66842 Bond ordering in noncrystalline solids. A.G.Revesz (COMSAT Labs., Clarksburg, MD, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.307-10 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
From the analysis of optical properties of noncrystalline (NC) and the corresponding crystalline solids with predominantly covalent bonds a bonding order parameter, F, is derived. This parameter reveals differences between NC solids which are characterized by similar degree of short-range-orders as, e.g., amorphous Si ($F \leq 0.8$) and vitreous SiO_2 ($F \simeq 1$). Both the optical and electrical properties indicate that, in contrast to amorphous solids, the electronic states in vitreous solids may remain delocalized even though there is no long-range-order. (21 refs.)

66843 Neutron diffraction study of amorphous binary alloys. T.Mizoguchi, N.Nishioka, S.Yamada, T.Suemasa, S.Yoda, N.Akutsu, H.Narumi, T.Kudo, M.Akimitsu (Faculty of Sci., Gakushuin Univ., Tokyo, Japan), N.Watanabe, M.Nishi, K.Motoya.
J. Phys. Colloq. (France), vol.43, no.C-9, p.659-70 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
For structural investigation of amorphous alloys TOF neutron diffraction experiments were carried out with the pulse neutron source at the National Laboratory for High Energy Physics in Japan. Results on Zr base 3d transition metal binary amorphous alloys especially Ni_xZr_{1-x} of wide composition range ($0.18 \leq X \leq 0.90$) are reported. Isotope substituted $Ni_{36}Zr_{.64}$ alloys were measured to get the partial structures. There seems to exist a chemical short range order in this amorphous alloy, resulting in a sharp Zr-Ni pair correlation and poor Ni-Ni nearest neighbor correlation. For ferromagnetic Fe-B amorphous alloys polarized neutron diffraction gives information about the partial structures. (10 refs.)

66844 Spatial charge fluctuations in amorphous silicon. J.Reichardt, R.L.Johnson, L.Ley (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.877-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
High resolution Si 2p core level spectra reveal a broadening for amorphous silicon (a-Si) compared to Cs-Si. This is due to static fluctuations in valence charges brought about by bond length and bond angle variations in the amorphous network. The observed Gaussian broadening of 256 meV corresponds to RMS deviation from charge neutrality of approximately 0.11 elementary charges. The addition of hydrogen reduces the charge fluctuations in proportion to the number of hydrogen atoms attached to a given silicon atom. The chemical shift induced by each hydrogen atoms is 0.34 eV which corresponds to a charge transfer of 0.15 electrons from silicon to hydrogen. (5 refs.)

66845 Structural order and optical properties of tetrahedral amorphous solids. N.Maley, L.J.Pilione, S.T.Kshirsagar, J.S.Lannin (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.880-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Raman scattering and optical absorption measurements indicate substantial changes in a-Si deposited under conditions of variable substrate temperature. The results indicate an approximately linear variation of the optical gap with the inverse width of the transverse optic-like band. This correspondence is also observed in preliminary studies of a-Ge for the depolarized Raman component. The variation of the depolarized spectra with deposition conditions is attributed to small modifications of short range order in both a-Si and a-Ge which alter the TO-like phonon half width. The correlation between changes in the Raman spectra and optical gap indicate that variations in both the phonon and electronic states in tetrahedrally coordinated amorphous solids are primarily due to modifications of the bond angle distribution. (11 refs.)

66846 Boron and hydrogen bonding in B-doped a-Si:H—an NMR study. S.G.Greenbaum, W.E.Carlos, P.C.Taylor (Naval Res. Lab., Washington, DC, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.886-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
^{11}B and ^{1}H NMR measurements performed on boron-doped films of a-Si:H prepared by glow discharge are reported. A sample containing 10 atomic % B exhibits two distinct boron sites, both of them being threefold coordinated. A second sample containing 0.7 atomic % B shows only one boron site, also threefold coordinated. Measurements of the ^{11}B spin-spin relaxation time T_2 indicate the boron sites are clustered in both the 10% B and 0.7% B materials. The temperature dependence of the ^{1}H spin-lattice relaxation time T_1 in the 10% B film does not exhibit the sharp T_1 minimum commonly observed in undoped a-Si:H films prepared by glow discharge. Suppression of the T_1 minimum in the B-containing material is explained in terms of a spin diffusion bottleneck in the relaxation pathway of the Si- or B-bonded protons in the film. (11 refs.)

66847 Small angle neutron scattering study of structural heterogeneities in a-Si:H. R.Bellissent (LLB, CENS, Gif-sur-Yvette, France), A.Chenevas-Paule, M.Roth.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.941-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Small angle neutron scattering measurements have been made on pure, hydrogenated or deuterated samples of amorphous silicon. The scattered intensity from the sputtered films indicate density fluctuations of average radius of gyration of about 125 Å. The presence of a ring at 0.22 $Å^{-1}$ on the diffraction pattern obtained from a-Si:H suggests a possible correlation length of about 30 Å. (12 refs.)

66848 Order and disorder in two-dimensional random networks. C.J.Lambert (Dept. of Phys. & Astron., Michigan State Univ., East Lansing, MI, USA), D.Weaire.
Philos. Mag. B (GB), vol.47, no.4, p.445-50 (April 1983).
The statistical properties common to a range of two-dimensional random networks are considered. In particular, Aboav's empirical relation for the average number of sides m_n on the neighbours of n-sided cells are examined. Attention is focussed not on the widely differing physical properties of these networks, but on the common topological properties as summarized by a general sum rule. An expression is obtained for the parameter **a** in Aboav's relation and in the case where skewness in the distributions can be ignored, **a** is shown to be simply related to the coefficient of kurtosis of the distribution function for n-sided cells. (8 refs.)

66849 Doping of amorphous silicon by implantation of manganese ions. A.V.Dvurechenskii, I.A.Ryazantsev, V.A.Dravin (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1271-3 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1969-73 (Nov. 1982). [received: April 1983]
Electrical and ESR measurements were used to study films of amorphous silicon (*a*-Si) deposited by evaporation and irradiated with Mn^+ ions in doses of 2×10^{15}-8×10^{16} cm^{-2}. It was established that the conductivity σ of *a*-Si:Mn films increased on increase in the dose Φ of the implanted dopant, the highest value reached being 0.3 $\Omega^{-1}.cm^{-1}$. The ESR signal due to intrinsic localized states (*VV* centers) increased on increase in the dose earlier in the case of *a*-Si:Mn than for samples of *a*-Si implanted with group II and V impurities. The temperature dependence of the conductivity of *a*-Si:Mn films recorded in the range 300-500K ($\Phi = 10^{16}$ cm^{-2}) had a linear region with an activation energy of 0.15 eV, which was attributed to the appearance of the manganese acceptor states in the pseudogap. The thermal stability of the conductivity of *a*-Si:Mn films increased on increase in the implanted impurity dose. The observed high doping efficiency and saturation of dangling bonds on introduction of Mn^+ into *a*-type Si was explained by a model of a complex containing the pentavalent impurity and a defect with a dangling bond of a silicon atom. It is suggested that such a complex is an acceptor. (11 refs.)

Ion-induced amorphous and crystalline phase formation in Al/Ni, Al/Pd, and Al/Pt thin films .... See Entry 67054

Composition, structure, and properties of pyrolytic iron oxide films .... See Entry 67390

Short-range order in amorphous thin films of indium selenides .... See Entry 67394

Pore structure of amorphous silicon .... See Entry 67396

Amorphous to microcrystalline transitions in Si films .... See Entry 67403

Metal-induced crystallization of hydrogenated amorphous Si films .... See Entry 67404

Anisotropic properties and structure of amorphous films of selenium .... See Entry 67410

Local structure and electronic states in hydrogenated amorphous silicon .... See Entry 67542

Local binding configuration of phosphorus in doped and compensated amorphous hydrogenated silicon .... See Entry 68075

Preservation of optical selection rules in an amorphous semiconductor .... See Entry 68142

An improved analysis of the OH stretching spectrum of amorphous solid water .... See Entry 68197

Raman scattering in highly disordered amorphous phosphorus .... See Entry 68227

Efficient visible luminescence from hydrogenated amorphous silicon .... See Entry 68313

Disorder and optical properties in gallium arsenide .... See Entry 68348

Crystallization of amorphous silicon films during low pressure chemical vapor deposition .... See Entry 68449

61.40D Glasses

66850 Ag photodoping of amorphous chalcogenides. S.A.Lis, J.M.Lavine (GCA Corp., Bedford, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.675-7 (15 April 1983).
Spectral measurements over the wavelength range of 400-800 nm on As_2S_3, As_2Se_3, and $GeSe_2$, measurements on a tuned structure of As_2S_3, and exact calculations on a multifilm structure support the recent suggestion that the photons relevant to the photodissolution of Ag are absorbed in the Ag and not in the chalcogenide. The observed spectral dependence may be fitted by an internal photoemission model. (5 refs.)

66851 Effect of low-temperature annealing on the structure of $Cu_{57}Zr_{43}$ glass. H.S.Chen, K.T.Aust, Y.Waseda (Bell Labs., Murray Hill, NJ, USA).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.153-7 (April 1983).
The authors present the results of new X-ray measurements on structural changes which occur in the $Cu_{57}Zr_{43}$ glass due to low-temperature annealing and also a comparison of the experimental data with the recent molecular dynamics simulation (S. Kobayashi and S. Takeuchi, 1982). (17 refs.)

66852 Effect of composition of glass ceramics of the system K_2O-SrO-BaO-Al_2O_3-SiO_2 on their structure and heat resistance. I.D.Tykachinskii, E.M.Konoval, G.V.Kataeva, T.P.Buyanova.
Inorg. Mater. (USA), vol.18, no.5, p.714-17 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.851-5 (May 1982). [received: Feb. 1983]
The structure of glass ceramics synthesized from strontium anorthite in combination with celsian depends essentially on the theoretically envisaged amount of potassium aluminosilicate glass phase (composition of leucite). The heat resistance of these materials depends not only on the amount of the glass phase, but much also on the structure formed in them. For instance, practically no reduction in heat resistance of the materials occurs upon addition of 10% glass phase and increase of the latter to 20% perhaps because of presence in the materials of a felted structure that creates a rigid framework capable of withstanding stresses at high temperatures (up to 1770K). With increase of the amount of the glass phase to 30% the structure of the material acquires a mosaic nature with fairly large speckled sites of glass phase that facilitate deformation under stress at high temperatures, which lower its heat resistance. (4 refs.)

66853 Amorphous to crystalline transformation of $Fe_{81}B_{13.5}Si_{3.5}C_2$. B.Bhanu Prasad, A.K.Bhatnagar (School of Phys., Univ. of Hyderabad, Hyderabad, India), R.Jagannathan.
J. Appl. Phys. (USA), vol.54, no.4, p.2019-24 (April 1983).
The crystallization of $Fe_{81}B_{13.5}Si_{3.5}C_2$ (Metglas 2605SC) has been studied by resistivity, differential thermal analysis (DTA), Mossbauer and X-ray techniques, and compared with reported results based on other techniques. The DTA shows in addition to the usual two peaks a third peak at 850K paralleled by a change in the resistivity measurements at the same temperature. The crystallization is found to take place gradually in the temperature region 750-810K with α-iron precipitating first. Mossbauer studies provides evidence for α-Fe, Fe_2B, and a species with a hyperfine magnetic field ~314 kOe which could not be unequivocally established. X-ray data shows evidence for the presence of Fe_3C in addition to α-Fe and Fe_2B. (28 refs.)

66854 Molecular dynamics study of triplet correlations in a rapidly quenched metal. I. Distribution of equilateral triplets. M.Tanaka (Dept. of Engng. Sci., Tohoku Univ., Sendai, Japan).

J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1270-7 (April 1983).

Short-range order of atoms in rapidly quenched states of a simple liquid metal simulated by the molecular dynamics method is investigated in detail by computing the triplet distribution function $g^{(3)}(r_{12}, r_{23}, r_{31})$. Splitting of the second peak of $g(r)$ is shown to reflect strong equilateral triplet correlations at low temperatures in the second-neighbour shell around an arbitrary atom. A glass structure of the quenched state examined with $g^{(3)}(r, r, r)$ is understood as a distorted and imperfect *f.c.c.* packing: the nearest shell around an arbitrary atom consists of the *f.c.c.* nearest-neighbours, occupancy of the second nearest-neighbour sites is suppressed very much, and the subpeaks in the second-neighbour shell correspond to the third- and the fourth-nearest neighbours. Correlations beyond the second-neighbour shell are more diffuse and similar to a liquid structure. (15 refs.)

66855 Atomic-scale structure of amorphous (Ni-Co)-(Zr-Hf) alloys. D.Lee (Korea Univ., Seoul, Korea), A.Lee, C.N.J.Wagner, L.E.Tanner, A.K.Soper.

J. Phys. Colloq. (France), vol.43, no.C-9, p.19-22 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The structures of amorphous $Ni_{35}Zr_{65}$ and (Ni-Co)-(Zr-Hf) alloys have been determined employing the variable 2θ angle X-ray method and the variable wavelength neutron technique. The partial interference functions (structure factors) $I_{ij}(K)$ have been evaluated using the isomorphous substitution method. (7 refs.)

66856 Determination by polarized neutron diffraction of the three partial structure factors of a $Co_{81.5}{}^{11}B_{18.5}$ glass. J.M.Dubois (Lab. de Metall., ENSMIM, Nancy, France), P.Chieux, G.Le Caer, J.Schweitzer, J.Bletry.

J. Phys. Colloq. (France), vol.43, no.C-9, p.23-9 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The three partial structure factors (PSF) of a $Co_{81.5}{}^{11}B_{18.5}$ glass were simultaneously measured by polarized neutron diffraction. A prepeak appears around $Q=2$ Å^{-1} on the nuclear structure factor. The concentration-concentration PSF shows that the boron atoms are only surrounded by cobalt atoms. The following pair distances are deduced from PSF: R(Co-Co)=2.54 Å, R(Co-B)=2.3 Å, R(B-B)~3.6 Å. Finally the PSF calculated for the model of Gaskell (1979) are in satisfactory agreement with the measurements while a slight discrepancy is observed between experiment and the S_{CC} FSP calculated for a packing of sticky spheres. (21 refs.)

66857 Neutron diffraction studies of rare earth ions in glasses. A.C.Wright, G.Etherington, J.A.Erwin Desa, R.N.Sinclair (J.J. Thomson Phys. Lab., Reading, England).

J. Phys. Colloq. (France), vol.43, no.C-9, p.31-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The environment of the rare earth ions in vitreous Sm_2O_3-$Al_2O_3GeO_2$ has been studied using the neutron diffraction anomalous dispersion technique and that in vitreous NaF-DyF_3-BeF_2 by isotopic substitution. The mean Sm-O and Dy-F distances are 2.420 and 2.301 Å respectively. (8 refs.)

66858 Scattering studies of photo-structural changes in chalcogenide glasses. S.R.Elliott, T.Rayment, S.Cummings (Dept. of Phys. Chem., Univ. of Cambridge, Cambridge, England).

J. Phys. Colloq. (France), vol.43, no.C-9, p.35-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Reports the first neutron scattering studies of the reversible photostructural changes in two chalcogenide glasses, As_2Se_3 and As_2S_3. The optically-induced changes extend to large values of Q, and are therefore caused by changes in the short-range order of the glass. The differences in the RDFs between illuminated and annealed samples show marked changes in the neighbourhood of the second-neighbour separation. The only model which fits the data is that of a photo-induced increase in bond-angle fluctuations by ~1°. (8 refs.)

66859 Determination of the local structure of metallic glasses by EXAFS. A.Sadoc, A.M.Flank, D.Raoux, P.Lagarde (LURE, Univ. Paris-Sud, Orsay, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.43-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The local structure of $Cu_{60}Zr_{40}$ and $Cu_{46}Zr_{54}$ amorphous alloys has been investigated by EXAFS. Moreover the effect of a structural relaxation has been studied in $Cu_{46}Zr_{54}$. (7 refs.)

66860 Local structures about some transition elements in oxide glasses using X-ray absorption spectroscopy. J.Petiau, G.Calas (Lab. de Mineralogie-Cristallographie, Univ. Paris VI et VII, Paris, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.47-50 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Absorption X-ray spectroscopy is used to study the local structure around transition elements (Cr-Fe-Co-Ni) in silicate and borate glasses. The complementarity of EXAFS, giving the neighbour distances, and of the near edge structure giving information about symmetry and chemical state is emphasized. (6 refs.)

66861 Chemical shifts of SiKα and AlKα in oxide glasses. T.Yanagase, K.Morinaga, S.Sumita (Dept. of Materials Sci. & Technol., Graduate School of Engng. Sci., Kyushu Univ., Fukuoka, Japan).

J. Phys. Colloq. (France), vol.43, no.C-9, p.51-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Chemical shifts of SiKα and AlKα in oxide glasses have been measured to find out the structure of SiO_2-complex anion and the oxygen co-ordination number of Al^{3+} by using high resolution X-ray fluorescence spectrometer (double crystal type). Optical basicity of these glasses proposed by Duffy and Ingram (1971) has been measured to discuss the chemical shifts of SiKα and AlKα. The relation between SiKα chemical shifts and the type of SiO_2-complex anions was derived by comparing with those standard samples. The distribution of SiO_2-complex anions was also determined by calculation with computer analysis. The results indicate that the chemical shift of SiKα has a linear relationship with the optical basicity of corresponding glasses. The structure and distribution of SiO_2-complex anions are discussed in terms of basicity of glasses. The chemical shift of AlKα has also a relationship with the optical basicity, which will lead to the discussion about the change of oxygen co-ordination number of Al^{3+} oxide glasses in terms of the basicity of glass. (13 refs.)

66862 Metallic glasses—some current issues. R.W.Cahn (Lab. de Metall. Phys., Univ. de Paris-Sud, Orsay, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.55-66 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Four aspects of the behaviour of metallic glasses are analysed in the light of recent results and theories: glass-forming ability of different alloys; structure and short-range order; the nature of free volume; thermal relaxation, reversible or irreversible. The concept of chemical short-range order runs as a common thread through these various issues, and some space is devoted to a historical resume of the study of SRO in crystalline solid solutions, in order to draw some instructive parallels. The special importance of establishing how SRO in glasses varies as a function of temperature is emphasised. (75 refs.)

66863 Structural description of transition metal-metalloid glasses. J.M.Dubois, G.Le Caer (Lab. de Metall., ENSMIM, Nancy, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.67-74 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

A structural description of transition metal-metalloid glasses is proposed. It is based on the structural operations which allow generating the crystalline counterparts. A demixion at a microscopic level is naturally introduced whose consequences on the structure are discussed. Experimental arguments in favour of such a description are given which should provide a basis for the prevision of some properties of metallic glasses. (38 refs.)

66864 Clusters and local chemical order in amorphous metal-metalloid alloys. F.Machizaud, F.A.Kuhnast, G.Mbemba, J.Flechon (Univ. de Nancy I, Vandoeuvre les Nancy, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.75-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Referring to the amorphous metal-metalloid alloys obtained by oxido reduction in the liquid phase and studied by X-ray diffraction, the authors state precisely in what manner they determine the amorphous structure through a detailed analysis: the mean local order is described by geometrical clusters situated in a disordered matrix. (8 refs.)

66865 X-ray scattering study of correlated fluctuations in metallic glasses. A.Naudon, A.M.Flank.

J. Phys. Colloq. (France), vol.43, no.C-9, p.79-82 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

An X-ray scattering study is carried out with a specific camera which records the intensities from the small-angle region to the first diffraction halo of an amorphous material. Cu-Ti metallic glasses prepared either by sputtering or by liquid-quenching are compared. In the former case, spatial correlated fluctuations take place in the amorphous alloy before crystallization. The results also show that the pre-peak which is revealed by X-rays must be attributed to the size effect. (10 refs.)

66866 Effect of isothermal annealing on the structure of an amorphous Pd-Si alloy. M.Laridjani (Lab. de Magnetisme, CNRS, Meudon Bellevue, France), J.F.Sadoc.

J. Phys. Colloq. (France), vol.43, no.C-9, p.83-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The effect of heating on the structure of amorphous Pd-Si alloys is presented. Quasi-reversible effects are observed prior to structural relaxation. (4 refs.)

66867 Covalent and ionic metallic glasses. J.Bletry (Saint-Gobain Recherche, Aubervilliers, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.87-90 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Shows the possibilities and the limits of models of adhesive spheres to describe the structure of covalent or ionic metallic glasses. (5 refs.)

66868 Recent results on the ideal structure of glasses. N.Rivier (Blackett Lab., Imperial Coll., London, England).

J. Phys. Colloq. (France), vol.43, no.C-9, p.91-5 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The ideal random structure is defined as the most probable distribution of cell shapes, subject to topological and space-filling constraints. This implies a linear relation between average volume of f-sided cells, and f. This has been observed in 2D tissues (Lewis's law). The average $\langle f\rangle$ is calculated. From $\langle f\rangle=13.40$ in undifferentiated tissues, it increases with anisotropy of the cells, and decreases if their sizes fluctuate. (12 refs.)

66869 A structural interpretation of the density of alkali silicate glasses. P.H.Gaskell (Cavendish Lab., Univ. of Cambridge, Cambridge, England).

J. Phys. Colloq. (France), vol.43, no.C-9, p.101-5 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Huggins's empirical formula giving the volume V_o per atom of oxygen is discussed in terms of structural concepts. (4 refs.)

66870 SAXS and TEM studies of phase separation in BaO-SiO_2 glasses. E.D.Zanotto, A.F.Craievich, P.F.James (Dept. of Ceramics, Glasses & Polymers, Sheffield Univ., Sheffield, England).

J. Phys. Colloq. (France), vol.43, no.C-9, p.107-10 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Amorphous phase separation was studied in the nucleation and growth region of the BaO-SiO_2 miscibility gap. Nearly spherical droplets were precipitated, the diameters obtained from SAXS and TEM being in reasonable agreement. The growth kinetics of the droplets were well described by the classical theory of coarsening. From the integrated SAXS intensities, the times to reach the equilibrium matrix compositions at 743 and 760°C were determined, and the binodal boundary located. Nucleation occurred during quenching from the melt or within a very short time of heat treatment. Coarsening began well before the attainment of the equilibrium matrix composition. (15 refs.)

66871 Short range structure and some physical properties of the glasses in the system Na_2O-Ga_2O_3-SiO_2. S.Goto, T.Hanada, R.Ota, N.Soga, N.Iwamoto, N.Umesaki (Dept. of Industrial Chem., Kyoto Univ., Kyoto, Japan).

J. Phys. Colloq. (France), vol.43, no.C-9, p.111-14 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The glass-forming region in the system Na_2O-Ga_2O_3-SiO_2 was determined, and the density, hardness and thermal expansion coefficient were measured. The glass-forming region in this system was found to be much wider than that in the Na_2O-Al_2O_3-SiO_2 system. The properties showed a sudden change at the composition of Ga/Na ratio=1. This anomaly is similar to that observed in the Na_2O-Al_2O_3-SiO_2 system. The results of IR spectra, X-ray emission spectra and X-ray diffraction patterns suggest that the non-bridging oxygens existing in sodium silicate glasses change into bridging oxygens with the addition of Ga_2O_3 at Ga/Na ratio less than 1 and then appear again along with the formation of Ga-O-Ga bonds with further addition of Ga_2O_3 over the Ga/Na ratio of 1. (9 refs.)

66872 Characterization and structure of intergranular vitreous phases in ceramics. J.Y.Laval, K.H.Westmacott, M.C.Amamra (Lab. d'Etude et de Synthese des Microstructures, CNRS-ESPCI, Paris, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.123-6 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The characterization techniques in electron microscopy for intergranular glassy phases in ceramics are reviewed and compared. The structure of the glassy phases was investigated in great detail, through electron induced processes. The time, voltage, beam current and temperature dependence of the growth rate of defects is consistent with an ionization damage process. From the interpretation of this process, a structural model was developed which has been confirmed by EXAFS spectroscopy and which postulates the presence of $M-O^-$ (M=glass-forming cation) dangling bonds and the influence of the valence state of the network-modifying cation. (9 refs.)

66873 The influence of melting condition on the radiation sensitivity of GeO_2 glass. R.A.Weeks, D.L.Kinser, G.Kordas, R.Magruder, M.Wells (Vanderbilt Univ., Nashville, TN, USA).

J. Phys. Colloq. (France), vol.43, no.C-9, p.149-53 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Effects of the fusion temperature and cooling rate on the concentration of the E_1 centers in GeO_2 glass are studied using EPR and optical methods. (5 refs.)

66874 Kinetics of glass formation and devitrification behavior. D.R.Uhlmann (Dept. of Materials Sci. & Engng., MIT, Cambridge, MA, USA).

J. Phys. Colloq. (France), vol.43, no.C-9, p.175-90 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The process of glass formation is viewed from a kinetic perspective. Initial attention is directed to the kinetics of nucleation, both homogeneous and heterogeneous, and of crystal growth. Information obtained in these areas is combined with treatments of crystallization during continuous cooling to evaluate the critical cooling rates required to form glasses of various materials. Consideration is given to the material parameters which are conducive to glass formation, and to the process of crystallization on reheating of glass. The kinetic treatment is also used to describe other phenomena such as the effects of nucleating heterogeneities on glass formation and the use of DTA experiments to evaluate the barriers to crystal nucleation. (46 refs.)

66875 Formation, properties and structure of fluoroborate glasses. Cheng Ji-jian, Chen Zu-xiong (Dept. of Materials Sci. & Engng., East China Inst. of Chem. Technol., Shanghai, China).

J. Phys. Colloq. (France), vol.43, no.C-9, p.219-22 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

6 regions of glass formation of the ternary systems: $Li_2O-LiF-B_2O_3$, $Na_2O-NaF-B_2O_3$, $K_2O-KF-B_2O_3$, $CaO-CaF_2-B_2O_3$, $SrO-SrF_2-B_2O_3$, and $BaO-BaF_2-B_2O_3$ are determined. The composition dependence of some physical properties of fluoroborate glasses is investigated. The results of IR and UV spectra, DTA and X-ray diffraction studies give reliable data concerning the replacement of O^{2-} by F^- in glass network. The formation of some oxyfluorogroups is proposed. The change of coordination number of boron atoms from 3 to 4 in different borate and fluoroborate glasses is discussed. A structure model of calcium fluoroborate glass is schematically represented. (3 refs.)

66876 Structural study of aluminium fluoroberyllate glasses. J.J.Videau, J.Portier, B.Piriou (Lab. de Chimie du Solide, CNRS, Talence, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.223-9 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Aluminium fluoroberyllate glasses (AFB) obtained in the vitreous state from the quaternary system $BaF_2-CaF_2-AlF_3-BeF_2$ have been studied by EPR, FLN and by Raman spectroscopy. In these glasses, three types of network forming groups are present: (AlF_6), (AlF_4) and (BeF_4). $(AlF_5)_n$ chains are cross-linked with (AlF_4) in small amount and with (BeF_4) tetrahedra. These fluoroberyllate tetrahedra are present as a more or less polymerised species $(Be_nF_{3n+1})(n+1)^-$. These ABF glasses must be distinguished from those rich in BeF_4 groups. The network of fluoroberyllate glasses is constituted of corner linked (BeF_4) tetrahedra. (14 refs.)

66877 An investigation of relationship between phase separation and crystallization of $ZnO-Al_2O_3-SiO_2$ glasses. Li Jiazhi, Shang Ying, Hu Guanging (Shanghai Inst. of Ceramics, Acad. Sinica, China).

J. Phys. Colloq. (France), vol.43, no.C-9, p.231-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

TEM, DTA, X-ray diffraction results reveal that there is a strong tendency to phase separation into two immiscible liquid phases in the $ZnO-Al_2O_3-SiO_2$ (ZAS) glasses. β-quartz solid solutions would precipitate as metastable initial crystalline phase, when the degree of phase separation of the original glass is low, whereas β-quartz solid solution and β-Willemite solid solution would both be precipitate when the degree of phase separation is more complete. It was found that degree of phase separation not only determines the initial crystalline phase, but also accelerates the crystallization of the ZAS glasses. (5 refs.)

66878 Structure and properties of TiO_2-SiO_2 and TiO_2-GeO_2 glasses. S.Sakka, K.Kamiya (Mie Univ., Mie-Ken, Japan).

J. Phys. Colloq. (France), vol.43, no.C-9, p.235-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The coordination of Ti^{4+} ions in the low expansion TiO_2-SiO_2 glasses made from metal alkoxides by the sol-gel technique and TiO_2-GeO_2 glasses made by melting was investigated on the basis of the observation of crystallization behaviour and the infrared spectroscopy. The α-cristobalite type SiO_2 and α-quartz type GeO_2 crystals containing 4-fold coordinated Ti^{4+} ions precipitated in the TiO_2-SiO_2 and TiO_2-GeO_2 glasses. Infrared spectra of the glasses were very similar to the corresponding crystallized products. These facts suggest that the Ti^{4+} ions in the TiO_2-SiO_2 glasses are 4-fold coordinated with oxygens as in the glasses made by the high temperature flame spray technique, and that Ti^{4+} ions in the TiO_2-GeO_2 glasses are also in 4-fold coordination. (8 refs.)

66879 Glass-forming tendency of Pb-containing multicomponent chloride and bromide melts. M.Yamane, S.Inoue, A.Nakamura (Tokyo Inst. of Technol., Tokyo, Japan).

J. Phys. Colloq. (France), vol.43, no.C-9, p.239-42 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The glass-forming tendency of Pb-containing multi-component chloride and bromide melts has been investigated. The experiment was extended from binary eutectic compositions containing $PbCl_2$ to ternary and quaternary systems containing the components which gave the good glass-forming tendency in the first test. The melt of $PbCl_2-AgCl-CsCl-CdCl_2$ system showed the highest-glass forming tendency among chloride systems studied. The melt of $PbBr_2-AgBr-CsBr-CdBr_2$ system had higher glass-forming tendency than chloride containing the same cations. The correlation between glass-forming tendency and melting temperature was discussed. (8 refs.)

66880 Effect of hafnium selenide (HfSe) on the crystallisation of the IR transparent chalcogenide glass $Ag_{10}Ge_{30}Se_{60}$. D.Hemeda, G.Tilloca (Lab. de Sci. des Materiaux, Univ. de Montepellier II, Montpellier, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.243-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

A study of the $xHfSe-(100-x)As_{0.1}Ge_{0.3}Se_{0.6}$ system ($0,1 \leq x$ mole $\% \leq 4$) was undertaken with the aim of transforming chalcogenide glass $As_{10}Ge_{30}Se_{60}$ into a vitroceramic maintaining good infra-red transmission in the 7-12 μm domain. The samples were prepared by fusion into vacuo of various components in fixed portions sealed into silica ampoules. Crystallization of glasses after heat treatment of 400-420°C was observed by scanning electron microscopy and X-ray diffraction. The influence on infra-red transmission and thermomechanical properties of vitroceramics is analysed. (7 refs.)

66881 The structure and properties of phosphate glasses with transition metals elements. J.Wasylak, J.Koprowaski, E.Czerwosz (Dept. of Glass, Univ. of Mining & Metall., Krakow, Poland).

J. Phys. Colloq. (France), vol.43, no.C-9, p.247-51 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Conditions of melting glasses of the $Ba(PO_3)_2-Y_2O_3(MoO_3)-TiO_2(Fe_2O_3)$ system and some of the properties of information on the structure of the glasses. In the glass matrix of the $Ba(PO_3)_2-Y_2O_3$ system were found structural metaphosphate and orthophosphate groups and crystal fragments. Electric properties: specific resistance (ρ_y), loss angle (tgδx) and permittivity (ε_r) indicated, the dielectric character for the glasses with Y_2O_3 and a highly semiconducting character for those with a greater context of Fe_2O_3. (3 refs.)

66882 Crystallization behaviour of gels and gel-monoliths in the $Na_2O-B_2O_3-SiO_2$ system. S.P.Mukherjee (Batelle's Columbus Labs., Columbus, OH, USA).

J. Phys. Colloq. (France), vol.43, no.C-9, p.265-9 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Gels and gel-monoliths in the sodium borosilicate system were prepared by the hydrolytic polycondensation of alkoxysilane with trimethyl borate or boric acid and a suitable sodium compound. Three different procedures using three different sources of Na_2O were developed. Crystallinity of different gel-powders and gel-monoliths of two compositions were examined after thermal treatment at different temperatures above the glass transition temperature (T_g). Results indicate that the stability of the gels towards crystallization during gel-to-'glass' transformation around T_g depends on the composition, previous thermal history and time and temperature of heat treatment. The results are explained in terms of gel structures and the nature and role of sodium ions in gel structures. (18 refs.)

66883 Microstructure vs. molecular structure of silica glasses from silicon alkoxide. G.J.Garvey, L.C.Klein (Ceramics Dept., Rutgers State Univ. of New Jersey, Piscataway, NJ, USA).

J. Phys. Colloq. (France), vol.43, no.C-9, p.271-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Using simple physical measurements, a picture was constructed of the microstructure of a dried monolithic silica gel prepared from tetraethyl orthosilicate (TEOS). The density and dimensions were measured. Weight loss was monitored during heating of the gel to a fully dense glass, and gases escaping during heating were analyzed. The results were interpreted for the dried gel and compared to published studies of its molecular structure. (14 refs.)

66884 Investigations of glass structure using fluorescence line narrowing and molecular dynamics simulations. M.J.Weber, S.A.Brawer (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).

J. Phys. Colloq. (France), vol.43, no.C-9, p.291-301 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The local structure at individual ion sites in simple and multicomponent glasses is simulated using methods of molecular dynamics. Computer simulations of fluoroberyllate glasses predict a range of ion separations and coordination numbers that increases with increasing complexity of the glass composition. This occurs at both glass forming and glass modifying cation sites. Laser-induced fluorescence line-narrowing techniques provide a unique probe of the local environments of selected subsets of ions and are used to measure site to site variations in the electronic energy levels and transition probabilities of rare earth ions. These and additional results from EXAFS, neutron and X-ray diffraction, and NMR experiments are compared with simulated glass structures. (25 refs.)

66885 Effect of light on structural relaxation in vitreous selenium thin films. J.P.Larmagnac, J.Grenet, C.Vautier (LECAP, Mont-Saint-Aignan, France).

J. Phys. Colloq. (France), vol.43, no.C-9, p.331-4 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The photo-dependence of the structural relaxation in glassy selenium has been studied by measuring T_g by DTA. The authors note an important increase in the relaxation rate towards equilibrium, for the strongly absorbed wavelengths. The relaxation rate increases as the sample thickness decreases. The relaxation of an existing configuration towards a more favourable one may be explained by the temporary creation of charged defect pairs and their excitation into neutral defects. It is assumed that the diffusion of defects to convenient sites gives rise to structural relaxation. (6 refs.)

66886 Structural investigation of molten and glassy silicates by means of infrared emission spectrometry. K.Kusabiraki, Y.Shiraishi (Res. Inst. of Mineral Dressing & Metall., Tohoku Univ., Sendai, Japan).
J. Phys. Colloq. (France), vol.43, no.C-9, p.351-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A direct method for observing the molecular vibration in the molten state has been developed by means of infrared emission spectrometry. The essential feature of this method consists of a combination of the two emission spectra which are obtained from thin and thick layers of the sample on a metal substrate. The transmission spectrum can be obtained from these emission spectra. The infrared emission spectra of molten alkaline silicates were measured in a range of wave number from 25000 to 400000 m^{-1} and the transmission spectra obtained in the molten state were compared with those of the glassy state. The cooling rate from molten to glassy state in the range of 10^{-2} to 10^4 K/s has little influence on the vibrational spectra of the glassy state. Although the general pattern of infrared spectra of molten silicates is quite similar to that of the glassy state, it is observed that the vibrational frequencies of molten silicates shift toward the lower frequencies and the band shapes are broader than those of glassy state. From the facts that the temperature dependence of these frequency shifts is linear during the transition from molten to glassy state, it may be concluded that the fundamental structure of silicate anion does not differ seriously in the two states. (8 refs.)

66887 Characterization and vibrational spectra of the vitreous domain existing in the ternary diagram Li_2O-CdO-P_2O_5. B.Elouadi, M.Ouchetto, C.Garrigou-Lagrange (Dept. de Chimie, Faculte des Sci., Rabat, Morocco).
J. Phys. Colloq. (France), vol.43, no.C-9, p.359-62 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
X-ray analysis carried out on supercooled melts of mixed Li and Cd phosphates has permitted the determination of the border of a wide glass forming region inside the ternary system Li_2O-CdO-P_2O_5. The heat stability of the isolated glasses has been determined using the annealing technique for 14 hours at different temperatures between 80 and 550°C for many compositions. Raman scattering was used to examine the evolution of glass structure inside the vitreous domain. (10 refs.)

66888 Deviations of structure between bulk and fiber glasses. H.Stockhorst, R.Bruckner (Inst. fur Nichtmetallische Werkstoffe, Tech. Univ. Berlin, Berlin, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.451-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Fibers from a silicate and a metaphosphate glass, produced by the nozzle drawing process are investigated with respect to their structural properties compared with bulk glass. The drawing parameters—nozzle temperature, mass flow and drawing speed—are varied in a wide range. The following properties are investigated: fiber density, thermal expansion-contraction-behaviour and optical birefringence. All these properties show characteristic deviations from the bulk glass values depending strongly on the drawing parameters. The fiber structure is mainly determined by the extreme high cooling rate and by the drawing stress acting on the gob during the fiber drawing process. (14 refs.)

66889 Effect of water content on properties of Na_2O3SiO_2 glasses. M.Takata (Technol. Univ. of Nagaoka, Niigata, Japan), M.Tomozawa, J.Acocella, J.Molinelli, C.Y.Erwin, E.B.Watson.
J. Phys. Colloq. (France), vol.43, no.C-9, p.455-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
$Na_20.3SiO_2$ glasses with up to $\simeq$12 wt.% water were prepared under high-pressure, hydrothermal conditions and their densities, glass transition temperatures, mechanical properties, electrical conductivities, sodium diffusion coefficients and radiation effects were measured. The density, glass transition temperature, hardness and brittleness decreased with increasing water content. The conductivity was to depend on H_2O content in a manner similar to the 'mixed-alkali' effect. Glasses with high water content were found to be extremely resistant to radiation coloration. (16 refs.)

66890 Study of the structural evolution in metallic glass $Fe_{83}B_{14}Si_{1.5}C_{1.5}$ by measuring internal friction and Young's modulus. F.Guyot, F.Fouquet, C.Mai, J.Perez (Groupe d'Etudes de Metall. Phys. et de Phys. des Materiaux, INSA de Lyon, Villeurbanne, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.595-9 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The influence of structural relaxation and of the onset of crystallization on ΔE effect and magnetomechanical damping has been studied in a ferromagnetic metallic glass $Fe_{83}B_{14}S_{1.5}C_{1.5}$. (11 refs.)

66891 Study of structural relaxation induced by irradiation of Se glass by measuring the micromechanical properties. S.Etienne, J.Y.Cavaille (Groupe d'Etudes de Metall. Phys. et de Phys. des Materiaux, INSA de Lyon, Villeurbanne, France), J.Perez, E.Bonjour, R.Calemczuk.
J. Phys. Colloq. (France), vol.43, no.C-9, p.599-602 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
γ irradiation effect on the structural relaxation of selenium glass around the glassy zone is studied by means of mechanical spectroscopy. It is observed (i) aging under γ irradiation permits the reach of structural states characterised by a low molecular mobility together with a high compactness. (ii) γ irradiation does not affect the structural state of the material in an irreversible way. These results are in agreement with those recently obtained using other techniques. (7 refs.)

66892 Magnetic properties and structure of ternary system glasses. C.Chaumont, J.C.Bernier (Dept. Sci. des Materiaux, CNRS, Strasbourg, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.685-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Magnetic properties of splat cooled glasses have been performed in ternary systems $xFe_2O_3(1-x)[BaO,B_2O_3]$ and $xFe_2O_3(1-x)[Li_2O,B_2O_3]$. In respect of Fe_2O_3 content the interpretation of experimental data leads to structural models with deformed tetrahedral and octahedral coordination for iron site. In these glasses, versus increasing Fe_2O_3 concentration, iron atoms are successively isolated, in dimeric or trimeric entities, in clusters in interactions and last in small crystallites. (6 refs.)

66893 Configurations of a chemically ordered continuous random network to describe the structure of $GeSe_2$ glass. R.J.Nemanich, F.L.Galeener, J.C.Mikkelsen,Jr., G.A.N.Connell (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), G.Etherington, A.C.Wright, R.N.Sinclair.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.959-61 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
It is proposed that the structure of $GeSe_2$ glass is characterized by a chemically ordered continuous random network. Within this context it is suggested that 4-atom planar rings exist and can explain an unusual feature in the Raman spectrum. Neutron scattering data are presented which support this model. (12 refs.)

66894 Local structures of amorphous As-chalcogenide systems by means of high Q-neutron scattering and infrared reflection. T.Arai, S.Onari, M.Kato, T.Mori, H.Saegusa, H.Yasuoka, M.Hatori, K.Ohkawa (Inst. of Appl. Phys., Univ. of Tsukuba, Ibaraki, Japan), T.Fukunaga, N.Watanabe.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.965-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Local structure of amorphous As-chalcogenide systems have been studied by means of high Q-neutron scattering and infrared spectroscopy. The local structures of the pyramidal molecular units in single crystals have been retained in the amorphous systems. The layer structure may have also been retained in the amorphous systems. (3 refs.)

Point defects and microstructural stability of glasses under irradiation .... See Entry 65437

Chalcogenide glasses—promising materials for quantum electronics. I. Interaction and structure of glasses in the As-S system .... See Entry 66360

Low temperature irradiation of amorphous Fe-B alloys .... See Entry 67036

Gamma irradiation induced photochemical reactions in V-doped borate glasses .... See Entry 67047

Effect of ion-beam damage on X-ray diffraction and Raman spectra of amorphous $GeSe_2$ .... See Entry 67059

Investigation of some cross-sections in the system As-S-Te .... See Entry 67169

Glass transition as a function of cooling rate .... See Entry 67207

Behaviour of germanium in phase separable glasses of the system Na_2O-B_2O_3-GeO_2-SiO_2 .... See Entry 67224

Heat capacity and medium range order in oxide glasses .... See Entry 67231

Thermodynamic relations between the crystallisation of amorphous alloys (Fe,B) and their preparation by hardening from the liquid state .... See Entry 67240

Viscous flow and relaxation phenomena in inorganic glass ...... See Entry 67258

Pre-vitrification viscosity enhancement by longitudinal mode coupling .... See Entry 67259

Ionic conductivity of Li_2O-$(LiCl)_2$-B_2O_3-Al_2O_3 glasses .... See Entry 67280

Application of nuclear analysis methods to nondestructive measurements of concentration profiles of the surface region of glasses by aqueous leaching .... See Entry 67320

Electrical properties of glasses and vitroceramics containing MnO_2 .... See Entry 67599

Influence of impurities on the electrical properties of $Se_{65}Te_{35}$ glasses .... See Entry 67609

Effect of composition on the structure and electrical properties of As-Se-Cu glasses .... See Entry 67705

ESR studies of radiation-induced tin centers in oxide glasses . See Entry 68012

NMR studies of the structure of glass .... See Entry 68048

Fe bonding short range order and magnetism in ternary oxide glasses .... See Entry 68098

Study of the structure of strontium- and titanium-containing aluminosilicate glass by Raman scattering .... See Entry 68193

Raman studies of B_2O_3 glass structure: $^{10}B \rightarrow ^{11}B$ isotopic substitution .... See Entry 68205

Raman study of $xB_2O_3.(1-x)SiO_2$ glasses obtained by hot pressing of gels .... See Entry 68206

Brillouin scattering observation of phonon scattering by inhomogeneities in phase separated glasses .... See Entry 68246

Spectroscopic properties of transition elements in glasses of geological interest .... See Entry 68274

Thermal evolution of alkali aluminosiicate gels .... See Entry 68500

Directionally crystallized potassium silicate glass-ceramic .... See Entry 68501

Synthesis of alloys and phase diagram of the Cs-Te system ... See Entry 68503

The AsSe-TlSe system .... See Entry 68517

The $TlAsSe_2$-Se system .... See Entry 68518

Physical aging of glasses .... See Entry 68580

Viscous failure of glass at high shear rates .... See Entry 68631

61.40K Polymers, elastomers, and plastics

66895 Measuring the degree of orientation of polymers by infra-red dichroism. V.A.Khranovskii.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.2, p.96-8 (1983). In Russian.
A study was previously made by V.A. Khranovskii (1978) of the characteristics of the orientation behaviour of soft and hard elements of films of segmented polyurethane carbamide subjected to uniaxial extension, the orientation characteristic f being calculated from the infra-red dichroism. The author examines the possibility of comparing the degree of orientation of soft and hard segments when these are oriented respectively parallel with and transverse to the plane of uniaxial extension. (6 refs.) *A.J.B.*

66896 Thermodeformation properties and structure of polyvinylalcohol films containing boron derivatives. L.I.Khomutov, L.G.Dubina, L.N.Verkhotina.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.2, p.116-18 (1983). In Russian.
An experimental investigation was made of the effect of heating no temperatures in the range 0-300°C on the thermodeformation characteristics of films of polyvinyl alcohol in both the pure state and after complexing with boric acid and sodium tetraborate. The plotted temperature-linear deformation curves show that the introduction of boric acid and a boron salt, which produces significant amorphisation of the polymer, suppresses the initial slight expansion shown by pure polyvinyl alcohol on heating, and causes a progres-

sive contraction on heating, amounting to 30% at 300°C. This degree of contraction could be explained by the presence of gelatine 'spirals' in the complexes polymer. (7 refs.) *A.J.B.*

66897 Influence of the structure of a three-dimensional network on the thermal shrinkage of a polymer. V.I.Dakin, V.L.Karpov.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.2, p.130-4 (1983). In Russian.
Formulae are derived, relating the theoretically-derived thermal shrinkage parameters of a polymer with the experimentally-determined parameters and with the characteristics of the molecular three-dimensional network of the polymer. These results are applied to polymer specimens based on polyethylene, with different network structures. The formulae permit a determination of the nature of change of these characteristics in relation to the structure of the polymer. (8 refs.) *A.J.B.*

66898 Crystallisation in oriented polymers: a framework for analysing orientation distributions. A.S.Abhiraman (Georgia Inst. of Technol., School of Textile Engng., Atlanta, GA, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.583-94 (April 1983).
A framework is presented for analysing the changes that occur in the orientation distribution of polymer segments when crystallisation occurs in an initially amorphous precursor. Existing theories which relate crystalline orientation distribution to that of the precursor can be incorporated in this framework in a straightforward manner. The orientation distribution of segments that remain uncrystallised is inferred from a kinetic analysis of the incorporation of precursor segments into growing crystals. The relevance of such a framework in understanding polymer fabrication processes is discussed briefly with examples in fibre formation from the melt. (19 refs.)

66899 Statistics of 'starburst' polymers. P.G.de Gennes, H.Hervet (Coll. de France, Paris, France).
J. Phys. Lett. (France), vol.44, no.9, p.L351-60 (1 May 1983).
Discusses the growth of a completely branched polymer, based on tertiary amine branch points connected by flexible linear portions ('spacers') each of P monomers. The method is a modified version of the Edwards self consistent fields. The authors find that ideal 'starburst' growth (without any residual secondary amine functions) is restricted to a number of generations $m \leq m_1$ where $m_1 \simeq 2.88(\ln P+1.5)$. This corresponds in space to a limiting radius R_1 which increases linearly with P. Well below this limit, the polymer radius $R(M)$, plotted as a function of molecular weight M, should increase like $M^{0.2}$. Above the limit ($R > R_1$) the authors expect compact structures ($R \sim M^{0.33}$). (4 refs.)

Low-angle X-ray camera for the investigation of polymers exposed to loads and ultraviolet radiation .... See Entry 66784

Radiation-induced crystallinity changes in linear polyethylene .... See Entry 67049

Transmission electron microscopy study of undoped and doped polyacetylene films .... See Entry 67402

TSC study of morphological modifications of rhodamine coloured PMMA .... See Entry 67638

^{13}C NMR analysis of propylene-butylene copolymers by a reaction probability model .... See Entry 68047

Polarized transmission and ATR studies of drawn polyethylene terephthalate films in the infrared .... See Entry 68343

EXAFS study of $FeCl_3$-doped polyacetylene .... See Entry 68364

Thermal annealing of doubly oriented nylon 11 in contact with formic acid .... See Entry 68538

The influence of low-temperature crystallisation on the tensile elastic modulus of natural rubber .... See Entry 68577

Ionomeric blends. II. Compatibility and dynamic mechanical properties of sulfonated , cis-1,4-polyisoprenes and styrene/4-vinylpyridine copolymer blends .... See Entry 68578

61.50 CRYSTALLINE STATE

(inc. molecular motions in solids; for magnetic structure and spin systems, see 75.25)

66900 Molecular motion, defect structures and phase transitions in oligomer crystals. G.R.Strobl, H.Schwickert, T.Trzebiatowski (Inst. fur Phys. Chem., Univ. Mainz, Mainz, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.274-9 (March 1983).
Defect structures in the high temperature modifications of oligomer crystals can generally be described as a superposition of chain rotations, longitudinal shifts of the molecules and the occurrence of conformational defects. Applying a suitable combination of experimental techniques it is possible to discriminate between the different components of disorder. This is demonstrated in a discussion of results obtained on n-alkanes, cycloalkanes and perfluoro-n-alkanes. (24 refs.)

66901 Peierls distortions in two and three dimensions and the structures of AB solids. J.K.Burdett, S.Lee (Dept. of Chem., Univ. of Chicago, Chicago, IL, USA).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1079-83 (9 March 1983).
Two- and three-dimensional analogues of the well-known Peierls distortion in one-dimensional solids can be used to view the structures of the group 6B and 5B elements and their derivative structures. Starting with the simple cubic structure, the β-tin, graphite, gallium, and arsenic structures are easily generated by this route. It is shown how with a large electronegativity difference between A and B the rocksalt structure (a derivative of the simple cubic arrangement) becomes stable for octet systems, the theoretical reasoning being exactly analogous to that used to stabilize square singlet cyclobutadienes by substitution. (31 refs.)

66902 Hydrogen motion in $Pd_3P_{0.8}H_{0.2}$. D.Noreus, U.Dahlborg (Dept. of Reactor Phys., Royal Inst. of Technol., Stockholm, Sweden), Y.Andersson, R.Tellgren.
Solid State Commun. (USA), vol.46, no.7, p.553-5 (May 1983).
A strong indication of an oscillatory hydrogen motion between two crystallographically equivalent sites separated by ~1.1 Å has been found in the $Pd_3P_{0.8}$ host lattice, at the temperatures 400 and 515K. (4 refs.)

Anisotropy of molecular oscillations as a factor in forming partially ordered structures .... See Entry 67152

Differential scanning calorimetry (DSC) at pressures up to 5 kbar. Configurational contributions of transition entropies in the plastic crystals cyclohexane and diamantane .... See Entry 67186

Dipolar reorientation and order-disorder behaviour of pure and mixed alkali cyanides .... See Entry 67193

Molecular motion in solid tetraethylammonium halides .... See Entry 68063

Infrared study of trapped carbon dioxide in thermally treated apatites .... See Entry 68926

61.50C Physics of crystal growth

(for techniques of crystal growth and film deposition, see 81.10 and 81.15; for epitaxy, thin films, see 68.55; for whiskers, see 68.70)

66903 Influence of gravitation on the processes of heat and mass transfer in solution crystal growth by the travelling heater methods (THM). III. T.A.Cherepanova, Y.V.Apanovich (Computing Center, Latvian State Univ., Riga, Latvian SSR).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.287-96 (1983).
The effect of the natural and thermocapillary convection on the vortex configuration in solution during growth of a PbTe crystal by the travelling heater method is considered. The estimation of the parameters of growth process (i.e. axial temperature gradients, gravitational acceleration, degree of the solution's surface contact with ampoule), when the vortex configuration undergoes qualitative variation, is given. In terms of the one-dimensional thermodiffusive problem solution the effect produced by the convective stirring on the position of growing and dissolving interfaces is described. (8 refs.)

66904 The influence of time dependence of temperature on the kinetics of nucleation. Z.Kozisek, Z.Chvoj (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.307-13 (1983).
The influence of time dependence of temperature on kinetic processes during nucleation on a simple model is studied. The nucleation rate and the average effective radius of nuclei R is calculated. It is proved that in the case of oscillating temperature the nucleation rate also oscillates and the rate of growth of radius R is directly proportional to frequency of temperature change. (5 refs.)

66905 Plastic bend in a growing crystal. L.G.Eidelman (All-Union's Res. Inst. for Single Crystals, Kharkov, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.405-13 (1983).
In case of nonlinear axial temperature distribution the relaxation of thermoelastic stresses results in the plastic bend of the growing crystal, i.e. in the generation of a residual lattice curvature equal to $\rho.b$. Based on results from Billig (1956) and from Indenbom (1961, 1964) the author presents estimation of dislocation densities (ρ) (i.e. residual lattice curvature) taking into account an elastic limit differing from zero. It is shown that sign and value of the residual lattice curvature may be effectively used as criteria pointing out how thermal conditions should be changed for obtaining more perfect crystals. This approach application allowed to grow larger KCl single crystals (300 m in diameter more than 100 kg by weight) with better structure perfection (specific subboundaries surface 2-3 cm^2/cm^3, mean subgrain dimension 0.6-1 cm, mean mutual disorientation of subgrains of nor more than 6′). (9 refs.)

66906 The melt growth of semicircular crystals of the pure Pb and its dilute alloys. S.Hayashi, M.Fukui, H.Komatsu (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.K38-42 (1983).
Semicircular crystals of Pb were grown from the melt by a rotational operation so as to change the orientation of the solid-liquid interface during crystallization. In pure Pb, specimens grew as polycrystals with grain boundaries developed transversely to the growth direction. According to the decrease in purity, the grown crystals consisted of several long grains along the circular arc. A competitive growth between grains was inhibited by a small amount of impurity and then the mode of growth approached to the complete adhesive one. (4 refs.)

66907 Crystallization of potassium sulfate from pure aqueous solution and in presence of surfactants. F.Kuschel, A.Konig, S.Herold (Sektion Chem., Bergakad. Freiberg, Freiberg, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.427-33 (1983).
The use of surfactants offers an interesting possibility in controlling crystallisation from solutions. There are already some applications in the technical field. However, little knowledge exists on the mechanism of the effect and its dependence on surfactant concentration. The displacement rates of selected single crystal faces of K_2SO_4 in pure aqueous solutions have been measured. The critical michelle concentrations have also been determined. Above a transition region characterized by a very irregular growth, growth was practically totally inhibited and dissolution observed. The surface morphology changes induced by surfactants have been investigated using phase contrast microscopy. (17 refs.)

66908 The effect of temperature on the kinetics of scale growth. F.Veverka, O.Sohnel, M.Hlavac (Res. Inst. of Inorganic Chem., Usti, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.527-33 (1983).
The temperature dependence of the kinetics of incrustations growth on heat-exchange surfaces from solutions of NH_4NO_3 was examined. With increasing temperature the formal kinetic exponent of growth decreases and the kinetic constant of growth increases. The linear rate of growth of NH_4NO_3 incrustations increases with rising temperature within the entire range of measured supersaturations. (3 refs.)

66909 The precipitation of alkaline-earth metal polymetaphosphate hydrate powders from aqueous solution. Nucleation and crystal growth processes, final precipitate compositions and crystal sizes. A.Packter, W.O.S.Doherty (Chem. Dept., North-East London Polytech., London, England).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.535-49 (1983).
The precipitation of barium, strontium, calcium and magnesium polymetaphosphate hydrates was studied from aqueous solutions of initial metal salt concentrations from 0.001 to 3M at 20°C; equivalent sodium polymetaphosphate solutions were added to the alkaline-earth metal chloride solutions. Precipitate compositions were determined by chemical analysis, paper chromatography, potentiometric analysis, thermogravimetric and differential thermal analysis and infra-red spectrophotometry; final crystallite morphologies and sizes were studied by scanning electron microscopy and X-ray powder diffraction. (18 refs.)

66910 Kinetics of crystal growth under conditions of low solubility of a crystal-forming substance in a matrix. B.E.Shenker, G.L.Kellerman, G.V.Kleshchev, A.I.Sheinkman, Yu.G.Raspopov (Chelyabinsk State Univ., Chelyabinsk, USSR).
Inorg. Mater. (USA), vol.18, no.5, p.703-5 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.838-40 (May 1982). [received: Feb. 1983]
The kinetics of the growth of titanium dioxide crystals in a melt are described by an exponential equation, the power of which varies over a wide range from 4.5 to 8.3, depending on the heat-treatment temperature. This is due to the

fact that the solubility of the dioxide in the melt is low, and growth of the crystalline particles takes place via a fluctuation mechanism. (11 refs.)

66911 Growth and morphology of single crystals of hexagonal molybdates(IV) $M_2Mo_3O_8$ (M=Mn, Fe, Co, Ni). P.Strobel, Y.Le Page (Solid State Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.329-38 (March 1983).
Chemical vapor transport in the M(II)-Mo(IV)-O system (M=Mn,Fe,Co,Ni) with HCl and $TeCl_4$ as transporting agents was studied. Crystals of the ternary oxides $M_2Mo_3O_8$ of 2 mm size were grown with $TeCl_4$ and their morphology was determined. The crystallization of Fe_2MoO_4 with HCl and of MoO_2 and Te with $TeCl_4$ was consistent with thermodynamic data predicting a higher transport rate of M in the HCl case and of Mo in the $TeCl_4$ case. Attack of the silica tubes was severe for M=Mn and Fe. (22 refs.)

66912 Growth morphology of polar crystals: a comparison between theory and experiment in sucrose. D.Aquilano, M.Franchini-Angela, M.Rubbo (Istituto di Mineralogia e Cristallografia Giorgio Spezia, Univ. di Torino, Torino, Italy), G.Mantovani, G.Vaccari.
J. Cryst. Growth (Netherlands), vol.61, no.2, p.369-76 (March 1983).
The theoretical growth morphology of sucrose has been deduced by means of the theory of Hartman and Perdok (1955). Only hydrogen bonds are considered to build up the periodic bond chains. The forms with F character are the following: $\{100\}$, $\{001\}$, $\{10\bar{1}\}$, $\{110\}$, $\{1\bar{1}0\}$, $\{011\}$, $\{0\bar{1}1\}$, $\{\bar{1}11\}$ and $\{1\bar{1}1\}$. A comparison is made between theoretical and experimental morphology of sucrose crystals grown from pure aqueous solutions. (43 refs.)

66913 Study of local variations in spacing and orientation in a Z-cut plate of a synthetic quartz crystal by X-ray topography. A.Zarka, Liu Lin (Lab. de Mineralogie-Cristallographie, Univ. Pierre et Marie Curie, Paris, France).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.397-405 (March 1983).
Lattice distortion measurements have been undertaken on a *Z*-cut plate of a synthetic quartz crystal, X-ray transmission topographs and plane-wave topographs enabled the authors to give a good assessment of the distortions observed in this crystal. The lattice spacing varies for different growth sectors in the range of $0<\delta d/d<10^{-5}$. Rotations of the (0001) lattice plane around the *Y* and *X* axis have also been measured. (11 refs.)

66914 Solution of partial differential equation of population balance by shifted Legendre polynomials. Maw-Ling Wang, Rong-Yeu Chang (Dept. of Chem. Engng., Nat. Tsing Hua Univ., Hsinchu, Taiwan).
J. Chin. Inst. Eng. (Taiwan), vol.6, no.1, p.31-8 (Jan. 1983).
The batch crystallization processes which are described by partial differential equations of the population density function with appropriate conditions are analyzed. The key method asserts that the population density function can be expressed by a series of shifted Legendre polynomial functions. An effective method which employs a shifted Legendre integral transformation associated with its polynomial functions is applied to solve population balance equations. Making the transformation, the partial differential equation is converted to a series of ordinary differential equations of expansion coefficients. The expansion of the population balance function into shifted Legendre polynomial functions is discussed in detail. The proposed method is straightforward for digital computation and accurate. Illustrative examples are given and compared with the results obtained by the moments method. (12 refs.)

66915 Nucleation and growth of cubic ice in LiCl.n D_2O glasses. A.Elarby Aouizerat, J.F.Jal, J.Dupuy, P.Chieux, A.Wright, R.Parreins (Dept. de Phys. des Materiaux, Lyon Villeurbanne, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.205-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The controlled nucleation of ice in metastable LiCl.n D_2O glassy samples has been followed by neutron scattering. The conditions were determined for cubic ice nucleation as well as for its transformation to hexagonal ice. The structure of the remaining disordered phase has been used to follow the glassy or supercooled matrix concentration along the various steps of the precipitation. A strong modification of the disordered structure is obtained in the nucleation stage. (13 refs.)

66916 The effects of crystallographic orientation, interface type and growth kinetics on Ni distribution between olivine and its melt. A.Kouchi (Inst. of Mineralogy, Petrology & Economic Geology, Tohoku Univ., Sendai, Japan), S.Hosoya, M.Kitamura, H.Takei, I.Sunagawa.
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.167-72 (1983).
The effective distribution coefficient K_{eff} of Ni between solid and liquid has been experimentally determined as a function of growth rates and crystallographic orientations for $(Mg, Ni)_2$-SiO_4 crystals grown by the floating-zone method. Crystals were grown by the continuous mechanism at slow rates, but were faceted at high rates, which enabled the authors to determine the dependence of K_{eff} on orientations and on smooth versus rough interfaces. It has been verified that K_{eff} of Ni becomes larger than the equilibrium value K_0 as the growth rate increases and that K_{eff} of faceted $\langle 110 \rangle$ directions is larger than that of non-faceted higher index directions. The results can be qualitatively explained by the theories which treat the distribution of elements in relation to the growth kinetics. Element distribution during the recovery process from rounded to faceted morphology is also analysed in detail. (35 refs.)

66917 The influence of growth conditions on strains in YAG crystals. A.Valcic, R.Roknic, S.Nikolic (Univ. of Beograd, Inst. for Chem., Technol. & Metall., Beograd, Yugoslavia).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.505-10
The shape of liquid/solid interface in crystal growth can greatly affect the crystal's characteristics. It also has a great effect on the growth mechanism affecting crystal characteristics. During the growth of YAG crystals there appear faces on the liquid/solid interface parts parallel to facets (211) and (110). The mechanism of the crystal's growth is different at the sections where faces appear and where they do not appear. These sections have various parameters of the lattice causing strain in the crystals. Laser rods of high quality could be obtained by cutting crystals of a large diameter out of parts without strain. (6 refs.)

Dislocation etching of tin iodide single crystals ....See Entry 66995

Inner differentiation of growth sectors induced by the interaction between dislocations and sector boundaries in KH_2PO_4 crystals ....See Entry 67030

Colling rate dependence of the icer I nucleation temperature in aqueous LiCl solutions ....See Entry 67171

Evaluation of the spin-up time during the accelerated crucible rotation technique ....See Entry 68418

An analysis of the derivative weight-gain signal from measured crystal shape: implications for diameter control of GaAs ....See Entry 68419

On iodine behaviour in bulk crystals of PbTe and SnTe synthesized by the iodide method ....See Entry 68420

Bridgman growth of Rb_2MnCl_4 via accelerated crucible rotation technique ....See Entry 68426

Heat transfer analysis of the Bridgman-Stockbarger configuration for crystal growth. I. Analytical treatment of the axial temperature profile ....See Entry 68427

61.50E Crystal symmetry; models and space groups, and crystalline systems and classes

66918 Weak asymmetry in β-Si_3N_4 as revealed by convergent-beam electron diffraction. Y.Bando (Center for Solid State Sci., Arizona State Univ., Tempe, AZ, USA).
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.185-9 (1 April 1983).
The thickness dependence of th apparent crystal symmetry in a pure β-Si_3N_4 crystal has been studied by the convergent-beam electron diffraction (CBED) technique. The $[11\bar{2}0]$ zone-axis CBED pattern for a thin crystal is compatible with the centrosymmetric space group $P6_3/m$, while that for a thick crystal would require the non-centrosymmetric space group $P6_3$. The thickness dependence of this result is discussed on the basis of the crystal structure of β-Si_3N_4 with space group $P6_3$, in which the structure contains a small antisymmetric group of nitrogen atoms. (10 refs.)

66919 Some additional changes in space groups in published crystal structures. R.E.Marsh, F.H.Herbstein (Arthur Amos Noyes Lab. of Chem. Phys., California Inst. of Technol., Pasadena, CA, USA).
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.280-7 (1 April 1983).
Revised structures are reported for ten crystalline compounds, based on space groups of higher symmetry than originally deduced. For two of them the Laue symmetry is changed, from $2/m$ to $\bar{3}/m$. For the remaining eight a center of symmetry has been added; for six of these the authors have been able to obtain *F* values and carry out least-squares refinements in the higher-symmetry space groups, with more satisfactory results than originally reported. (21 refs.)

66920 Point symmetry of crystals with a triclinic local order parameter. A.Ya.Mitus', A.Z.Patashinskii (Inst. of Nuclear Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1633-6 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2881-7 (Oct. 1982). [received: April 1983]
An earlier theory of crystal ordering is used to investigate the general case when the local ordering has the lowest admissible symmetry. The local crystal order parameter is an irreducible tensor of rank four $\Lambda_0^{(4)}$ of triclinic symmetry. An expansion of $\Lambda_0^{(4)}$ in terms of point symmetries is obtained and its geometric interpretation is given. The role of the liquid crystal order parameter in phase transitions in a crystal is discussed. General results of the proposed theory and the expansion of $\Lambda_0^{(4)}$ are used to derive an algorithm for the change of the point symmetry due to crystallization and due to phase transitions in a crystal. (8 refs.)

Analysis of the incommensurate structure in $Sr_2Nb_2O_7$ by electron microscopy and convergent-beam electron diffraction ....See Entry 66947

Group-subgroup phase transitions, Hermann's space-group decomposition theorem, and chain subduction criterion in crystals ....See Entry 67167

61.50J Crystal morphology and orientation

Growth and morphology of single crystals of hexagonal molybdates(IV) $M_2Mo_3O_8$ (M=Mn, Fe, Co, Ni) ....See Entry 66911

Growth morphology of polar crystals: a comparison between theory and experiment in sucrose ....See Entry 66912

Study of local variations in spacing and orientation in a Z-cut plate of a synthetic quartz crystal by X-ray topography ....See Entry 66913

61.50K Crystallographic aspects of polymorphic and order-disorder transformations

66921 Pressure necessary for polymorphic transitions in pyrochlore structures. S.I.Urbanovich, L.G.Nikiforov (Inst. of Solid State Phys. & Semiconductors, Acad. of Sci., Byelorussian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.856-8 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1017-19 (June 1982). [received: Feb. 1983]
The pressures necessary for the polymorphic transition of pyrochlore structures to more compact modifications are investigated. The values found agree with the results of other calculations and with the experimental data. (13 refs.)

Behaviour of the AB_2 type compounds at high pressures and high temperatures ....See Entry 64600

Polymorphism in organo-metallic bidimensional structures: the bis (n-octylammonium) tetrachlorocadmate ....See Entry 67191

Theory of order-disorder transitions for inhomogeneous mixed-valence systems ....See Entry 67546

61.50L Crystal binding

66922 Lattice energy of γ-Al_2O_3 & Fe_3O_4 ionic solids with spinel structure. S.Mazumdar, B.Mukherjee (Central Glass & Ceramic Res. Inst., Calcutta, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.982-3 (Dec. 1982). [received: April 1983]
Ewald's method of calculating the lattice sum and hence the Madelung factor is adopted to calculate the lattice energy of γ-Al_2O_3 and Fe_3O_4 ionic solids having spinel structure. (3 refs.)

66923 Molecular orbital calculation of several ices using the pseudolattice method. Kyoung Tal No, Mu Shik Jhon (Dept. of Chem., Korea Advanced Inst. of Sci. & Technol., Seoul, Korea).
J. Phys. Chem. (USA), vol.87, no.2, p.226-31 (20 Jan. 1983).
Molecular orbital (MO) studies of several ices (I_h, I_c, III, IX, VI) were made by using the pseudolattice method. According to the method water molecules in the ice model experience an identical environment without using periodic boundary conditions. It is found that the stability of ice I_h compared to I_c has its origin in the structural difference of the hydrogen bond parallel to the *c* axis. The difference in binding energy between proton-order and proton-disorder ice I_h is negligible (0.01 kcal/mol), and thus the residual entropy of ice I_h becomes important for determining the proton orderliness. In ice III, the model in which hydrogen atoms are aligned on the O-O bond is energeti-

cally favorable. Linear hydrogen-bond models of ice III and ice IX cannot discriminate between the stability of ice III and ice IX. In ice VI, a linear hydrogen-bond model is considerably unstable because of the repulsive contact of non-hydrogen-bonded neighbors. (38 refs.)

66924 Site preference of dilute hydrogen in palladium. M.I.Darby (Dept. of Pure & Appl. Phys., Univ. of Salford, Salford, England).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L41-3 (April 1983).
A H atom entering the FCC lattice of Pd occupies the octahedral interstitial site in preference to the tetrahedral site. Results are presented which show that the octahedral site is favoured if there is a much smaller difference in the screening for the two sites. Calculations are preformed of the total energy change for the two types of site. (8 refs.)

66925 Van der Waals interactions in the lattice of metallic chains. S.Barisic (Dept. of Phys., Zagreb Univ., Zagreb, Yugoslavia), A.Bjelis.
J. Phys. Lett. (France), vol.44, no.9, p.L327-32 (1 May 1983).
The cohesive energy of a lattice of metallic chains is calculated as a perturbation expansion of the Coulomb interaction, which is assumed small relative to the intrachain overlap integrals. The expansion contains the Van der Waals like interactions associated with the metallic polarizabilities of the chains. For sufficiently large forward interchain coupling (backward contribution neglected), the Van der Waals energy gained on going from the HMTTF-TCNQ to TTF-TCNQ lattice competes with the corresponding loss of the Madelung energy of the charges homogeneously distributed along the chains. (22 refs.)

66926 Electrostatic potentials using direct-lattice summations. V.R.Marathe, S.Lauer, A.X.Trautwein (Inst. fur Phys., Medizinische Hochschule Lubeck, Lubeck, Germany).
Phys. Rev. B (USA), vol.27, no.8, p.5162-5 (15 April 1983).
A direct-lattice summation scheme is described which is completely general for one-, two-, and three-dimensional periodic arrays of point charges. This scheme is based on a proper rearrangement of terms within the lattice sum. Rapid convergence is achieved by appropriate cancellation of multipolar terms. (11 refs.)

Growth morphology of polar crystals: a comparison between theory and experiment in sucrose ......See Entry 66912

The chemical bonding in lithium metaborate, LibO$_2$. Charge densities and electrostatic properties ......See Entry 66945

The charge density distribution in LiAlB$_{14}$ ......See Entry 66951

Structural studies of low temperature ice I$_h$ using a central force potential model ......See Entry 66955

Static and structural properties of III-V zincblende semiconductors ......See Entry 66967

Charge distribution from least-energy structure in Ca-Mg orthosilicates ......See Entry 66969

Shape dependence of the elastic energy in hydrogen-metal alloys ......See Entry 67146

Anisotropy of molecular oscillations as a factor in forming partially ordered structures ......See Entry 67152

Hydride stability and band structure of the components in the Pd$_{1-x}$M$_x$ and LaNi$_{5-x}$M$_x$ systems ......See Entry 67222

Electronic structures of higher stage graphite intercalation compounds ......See Entry 67420

Cohesive energy in strongly correlated electronic systems in the non-degenerate band approximation ......See Entry 67422

Analytic calculation of the structural properties of semiconductors ......See Entry 67500

The cluster-lattice interaction in the calculation of the electronic structure of CrF$_6^{3-}$ in K$_2$NaCrF$_6$ ......See Entry 67548

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu$_2$O$_2$*X*, *X*=O, S, Se ......See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu$_2$O$_2$Te ......See Entry 67904

61.55 SPECIFIC STRUCTURE OF ELEMENTS AND ALLOYS

61.55D Nonmetallic elements

66927 Structure of 'Orange' $^{18}O_2$ at 9.6 GPa and 297K. D.Schiferl, D.T.Cromer, L.A.Schwalbe, R.L.Mills (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.153-7 (1 April 1983).
A single crystal of 'orange' $^{18}O_2$ at 9.6(3) GPa and 297(1)K was produced in a Merrill-Bassett diamond-anvil high-pressure cell and examined by X-ray diffraction. Pressure was determined with the ruby-fluorescence method. The unit cell is orthorhombic, space group *Fmmm*, lattice constants $a=4.2151(6)$, $b=2.9567(4)$, $c=6.6897(17)$ Å, molar volume$=12.56\times10^{-6}$ m^3 mol^{-1} with four molecules per unit cell. The charge densities of the molecules overlap or distort to a considerable degree. Generalized scattering factors were used in an aspherical-atom least-squares refinement. For five refined parameters and 24 observations the final R_w is 0.056. (27 refs.)

Structural features of amorphous and crystalline red phosphorus ......See Entry 66833

61.55F Metallic elements

66928 The A-15 phase of elements. Yu.I.Vesnin (Inst. of Inorganic Chem., Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.486-8 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.183-5 (May-June 1982). [received: Feb. 1983]
It is known that various metals (for example W) can be obtained in the form of a polymorphic modification having a structure of the type A-15. It was recently found that Nb containing small quantities of added Ge or Si can also crystallize in this structure. It was shown that Vegard's law is effectively fulfilled in the Nb-Ge system over a wide range of concentrations (0.25 at.% Ge). This fact, and also various characteristic features of the phase diagrams of binary systems T-X (where T is a transition metal, and X is any element), indicate that a considerable number of elements T and X may exist in the form of modifications having the A-15 structure. The extrapolation (according to Vegard's law) of data of the lattice parameter of the phase A-15 in its homogeneity range for the systems V-X, Nb-X, and TA-X is presented. The values of the lattice parameter for the elements in the structure of the type A-15, extrapolated from data for different systems, show good agreement (the average discrepancy for three elements T and five elements X does not exceed 0.5%). (7 refs.)

Visual training aids, set no.15: steel and cast-iron (crystalline) structures ......See Entry 64642

61.55H Alloys

66929 A transmission electron microscopical study of the σ phase in an iron-chromium steel. P.G.Self (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England), M.A.O'Keefe, W.M.Stobbs.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.197-209 (1 April 1983).
This paper details several aspects of the σ phase in a duplex stainless steel. The growth and morphology of the phase is characterized and it is demonstrated that under certain conditions the nature of the nucleation and growth produces faulting within the σ-phase particles. The crystalline structure of the phase is discussed with reference to the possibility that it might be that of β-uranium rather than that previously reported. In this connection a comparison is made of the relative usefulness of high resolution and various indirect methods for analysing the structure. In particular, the absences in diffraction patterns and their dependence on crystal tilt and thickness offer an insight into the requirements for accurate structure determination by high-resolution electron microscopy. Finally, the fault structure is examined and a planar (110)-type fault is discussed in detail. (20 refs.)

66930 High pressure phases in the Mn-Yb system. A.V.Tsvyashchenko, S.V.Popova (Inst. of High Pressure Phys., Acad. of Sci., Moscow, USSR).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.211-15 (April 1983).
The crystallization of the intermetallic compounds in the Mn-Yb system was investigated at a pressure of 7.7 GPa and temperatures up to 1300°C. The new phases Yb_6Mn_{23}, Yb_2Mn_{17} and Yb_4Mn_3, all of which are metastable at room pressure, were found under these conditions. (6 refs.)

66931 X-ray investigation of the rare earth metal-iron triad metal-boron systems. Yu.B.Kuz'ma, N.S.Bilonizhko, N.F.Chaban, G.V.Chernyak (I. Franko Lvov State Univ. Lvov, USSR).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.217-22 (April 1983).
Phase equilibrium diagrams were established for the (Nd,Gd)-Ni-B systems. New borides were obtained in the R-(Fe, Co, Ni)-B systems (R≡rare earth) and their crystal structures were determined. The borides $R_3Ni_{13}B_2$ (R≡Tb, Dy, Ho, Er, Tm) have structures of the $Nd_3Ni_{13}B_2$ type, RFe_4B(R≡Er, Tm, Lu) and RNi_4B (R≡La, Pr, Nd, Sm) have the $CeCo_4B$ structure and $Nd_2Co_5B_2$ has the $Ce_2Co_5B_2$ structure. The dependence of the unit volume on the atomic number of the rare earth metal was examined for the series of compounds $R_3Ni_{13}B_2$, RNi_4B, $RCo_{12}B_6$ and $RNi_{12}B_6$. (22 refs.)

66932 High temperature equilibria between BCC and MgCu$_2$-type structures in the Zr$_{1-x}$M$_x$W$_2$ and Hf$_{1-x}$M$_x$W$_2$ (M≡Al,Si) systems. Z.Blazina, Z.Ban (Inst. 'Ruder Boskovic', Faculty of Sci., Univ. of Zagreb, Zagreb, Yugoslavia).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.223-31 (April 1983).
X-ray and metallography investigations of the $Zr_{1-x}Al_xW_2$, $Zr_{1-x}Si_xW_2$, $Hf_{1-x}Al_xW_2$ and $Hf_{1-x}Si_xW_2$ systems were carried out. All the ternary systems investigated showed marked similarities with respect to the limiting concentrations of substituents which corresponded to the formulae $Zr_{0.5}M_{0.5}W_2$ and $Hf_{0.5}M_{0.5}W_2$ (M≡Al, Si). Below a critical temperature all the systems consist of two coexisting phases, a b.c.c. ternary solid solution and a ternary Friauf-Laves structure of the $MgCu_2$ type. The precipitation and/or dissolution temperatures of the $MgCu_2$ phase in the b.c.c. matrix were determined for samples of all the systems investigated. Intensity calculations showed that the substitution in the $MgCu_2$-type structure was unequivocally associated with the 8a positions in the *Fd3m* space group. No ordering phenomena was observed in the high temperature b.c.c. solid solutions. The surprisingly small variations in the lattice constants of both phases and the corresponding short W-W distances are discussed. (3 refs.)

66933 Site occupancies and stoichiometries in hydrides of intermetallic compounds: geometric considerations. D.G.Westlake (Materials Sci. & Technol. Div., Argonne, Nat. Lab., Argonne, IL, USA).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.251-73 (April 1983).
Hole sizes and intersite distances were calculated at various hydrogen concentrations for the interstices in hydrides of $TiCr_{1.8}$, $ZrTi_2$, ZrV_2, $ZrCr_2$, $ZrFe_2$, HfV_2 and TaV_2 with the cubic $MgCu_2$ C15 structure and of $ZrMn_2$ and $ErMn_2$ with the hexagonal $MgZn_2$ C14 structure. From a survey of other metallic hydrides, empirical criteria were chosen for the minimum hole size (0.40 Å) and the minimum H-H distance (2.1 Å) for hydrogen atom occupancy in stable hydrides. With these criteria, a model was developed for predicting which sites and how many of them could be occupied by hydrogen atoms in each of the intermetallic compounds listed. The resulting stoichiometries were determined by experimentally filling the interstices of model lattices constructed of Friauf polyhedra without violating either of the adopted geometric criteria. (44 refs.)

66934 On some ternary La-Co-Zn alloys. V.Contardi, G.Zanicchi, R.Marazza, R.Ferro (Inst. of General & Inorganic Chem., Univ. of Genoa, Genoa, Italy).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L25-6 (April 1983).
Reports crystal structure data for the ternary alloys, $La(Co,Zn)_{13}$. The materials were examined using a metallographic microscope and by X-ray power diffraction. (12 refs.)

66935 Lattice parameters of RZnTl compounds (R≡rare earth element). D.Mazzone, D.Rossi, R.Marazza, F.Ferro (Istituto di Chimica Univ de Genova, Genoa, Italy).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L35-6 (April 1983).
Reports a study of the lattice parameters and unit cell dimensions by X-ray powder diffraction for the alloys: LaZnTl, CeZnTl, NdZnTl, SmZnTl, GdZnTl, DyZnTl, ErZnTl. (3 refs.)

66936 Powder neutron diffraction study of nickel-titanium martensite. W.Buhrer (Inst. fur Reaktortech., Swiss Federal Inst. of Technol., Wurenlingen, Switzerland), R.Gotthardt, A.Kulik, O.Mercier, F.Staub.
J. Phys. F (GB), vol.13, no.5, p.L77-81 (May 1983).
The structure of the martensitic phase of the shape memory alloy NiTi has been determined from a power neutron diffraction study at 10K. The lattice is monoclinic, space group $P2_1/m(C_{2h}^{\,2})$ with $a=2.884(2)$ Å, $b=4.110(2)$ Å, $c=4.665(3)$ Å, $\beta=98.10(4)°$ and $Z=2$. The structure has been refined to an $R_{WP}=0.12$; remaining descrepancies are associated with shape memory effects and are discussed in relation to the phase transition. (14 refs.)

66937 Monocarbide characterization in nickel-base MC aligned eutectics. M.R.Jackson, M.F.X.Gigliotti, S.W.Yang, J.L.Walter (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.155-65
In the aligned Ni-MC eutectic alloys being developed for jet engine blade applications, the fibers are considered to be TaC, TiC, etc. In fact, these fibers will contain Cr, Mo, W and possibly other elements as substitutions for the 'M' constituent, and often will not be stoichiometric. Quantitative chemical analysis of fibers is difficult because of their size. However, lattice parameter measurements can be used to learn much about the carbide chemistry and stoichiometry. Results are for fibers extracted from simple Ni-TaC, Ni,Cr-TaC and Ni,Cr, Al-TaC systems. In addition, experiments on mixed (Ta,V)C and (Ta,Ti)C carbides are discussed. Carbide lattice parameters can be understood in terms of the free energies of formation of the various carbides. (15 refs.)

Visual training aids, set no.15: steel and cast-iron (crystalline) structures .... See Entry 64642

Site preference of dilute hydrogen in palladium .... See Entry 66924

On the construction of a statistical model for primary solid solutions of hydrogen in the group Va transition metals (vanadium, niobium and tantalum) .... See Entry 67223

X-ray determination of the thermal expansion of Ti_3Au .... See Entry 67244

Lattice thermal expansion of Nb_3Os .... See Entry 67246

Effects of high pressure-high temperature treatment on the structure composition and superconductivity of $Nb_3(Al,Ge)$ .... See Entry 67829

Microstructures of the alloys in the system Pd-In-Sn .... See Entry 68508

On the structure of α'_m-precipitates in Al-Zn alloys .... See Entry 68545

An X-ray diffraction study of lattice imperfection in cold-worked FCC alloys. IV. Copper-germanium (alpha-phase) .... See Entry 68560

The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys .... See Entry 68610

Diffractometer determination of the fine-structure parameters in surface layers of a material .... See Entry 68710

61.60 SPECIFIC STRUCTURE OF INORGANIC COMPOUNDS

66938 Non-linear model of structures and phase transitions of the SiO_2 crystal family. G.Behnke, H.Bilz, H.Buttner (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.193-6 (March 1983).
The polymorphism and the phase transitions of the silica family are explained in terms of a quasi-one dimensional lattice model. The origin of the different SiO_2-structures is found in two microscopic potentials. The first potential describes the covalent bonding due to the tetrahedral (sp^3) silicon coordination and the twofold ($p\sigma$) oxygen coordination. The second potential is a local double-well potential due to the non-linear polarizability of the non-bonding ($p\pi$) electrons at the oxygen site. This potential is equivalent to a fourth-order electron-lattice interaction which may be responsible for the low-symmetry modifications of the SiO_2-crystals. It turns out that the different crystals with 1,2,3,4 and 6-fold screw axes correspond to possible commensurate static solutions of the potential. The model also includes incommensurate states which may be interpreted as the vitreous structures of the silica. (14 refs.)

66939 Orientational disorder of complex cations and anions in high-temperature phases of ionic compounds. Results of three-dimensional electron density calculations on the basis of X-ray diffraction data. H.J.Berthold, H.-G.Bathge, B.G.Holscher, H.-J.Kienert, W.Ludwig, J.M.Molepo, R.Wartchow (Inst. fur Anorganische Chemie, Univ. Hannover, Hannover, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.245-8 (March 1983). In German.
The crystal structures of the orientationally disordered cubic high-temperature phases of $NaClO_4$, $RbClO_4$, $CsClO_4$, $AgClO_4$, and $Co(C_5H_5)_2ClO_4$ have been investigated using single crystal X-ray diffraction data. In the case of $NaClO_4$ and $AgClO_4$ the ClO_4-tetrahedra occupy 6 orientations, characterized by the fact that in each orientation only one of the three $\bar{4}$-axes of the tetrahedra lies parallel to the cubic crystal axes. In $RbClO_4$ and $CsClO_4$ the orientational disorder comprises 2 orientations of the ClO_4-tetrahedra. In both of them all three $\bar{4}$-axes simultaneously point into the directions of the cubic crystal axes. $Co(C_5H_5)_2ClO_4$ transforms at 376K from the tetragonal room-temperature structure (space group I4/mcm, $Z=16$) into a primitive cubic structure (space group Pm3m, $Z=1$), in which the sandwich-like $Co(C_5H_5)_2^+$-cations and the ClO_4^--anions are orientationally disordered. The electron density distribution around the Co-atom proves that the cations occupy statistically three different orientations with the fivefold axis parallel to the *x*-, *y*-or *z*-direction. (16 refs.)

66940 Investigation of the structure of solid solutions of elements of the IV. Group (Si, Ge) in gallium antimonide. J.Wilke, V.T.Bublik, V.B.Osvenskii, A.N.Popkov, A.G.Braginskaya, G.P.Kolchina (Moscow Inst. of Steel & Alloys, Moscow, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.329-37 (1983).
Precision measurements of the lattice parameter and the density of Si- and Ge-doped GaSb monocrystals were accomplished. The investigated crystals were Czochralski-grown from an equiatomic melt (with respect to its own components) and doped with 2×10^{17} to 4×10^{19} cm^{-3} Si and 2×10^{17} to 4×10^{19} cm^{-3} Ge, respectively. The concentrations of the dopants were determined spectroscopically. Hall measurements at room temperature showed that Si as well as Ge in GaSb produce p-conduction. (2 refs.)

66941 Anisotropy of temperature factors and interatomic forces in II-IV-V_2 semiconductors. A.A.Vaipolin (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.415-21 (1983).
An incomplete set of X-ray reflections with high indices ('back' reflections by $MoK_{\alpha1}$-radiation) was measured for six II-IV-V_2 semiconducting compounds of the chalcopyrite structure. The site parameter of the V-atom and the temperature parameters proportional to the components of mean square displacements of atoms ($B_{ik}=8\pi^2\bar{u}_{ik}^2$) were determined. General peculiarities of the relation of temperature factor constants and its variation within this family of compounds are reported. A qualitative crystallochemical interpretation of this relation is proposed on the basis of the atomic interaction scheme taking into account the principal and auxiliary bonds in the first and the second coordination sphere, respectively. (6 refs.)

66942 The influence of Bi on the lattice constant and the carrier concentration of PbTe. Ngo Dien Tap, M.Schenk, P.Schafer (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.K33-4 (1983).
The authors investigated the connection between Bi content N_{Bi}, carrier concentration *n*, and lattice constant *a* of TbTe(Bi) epitaxial layers. The layers were investigated by high precision lattice constant measurements, carrier concentration measurements, and modified mass spectroscopic measurements. It was concluded that Te excess atoms, originated by the incorporation of Bi at cation lattice sites, cause Pb vacancies. (6 refs.)

66943 Precision lattice parameter determination of coloured quartz monocrystals. S.Grosswig, J.Hartwig (Friedrich-Schiller-Univ., Jena, Germany), U.Alter, A.Christoph.
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.501-11 (1983).
Several possibilities for the determination of relative lattice parameter changes and for the absolute measurement of lattice parameters are discussed. Special attention has been given to a measuring device for the high-precision lattice parameter determination using the BOND method. This device allows one to determine the lattice parameters with a relative accuracy of 2×10^{-7}. As an example the methods discussed are applied to the investigation of a smoky coloured quartz crystal plate and the results obtained by them are compared. (40 refs.)

66944 The effects of anisotropic atom-atom interactions on the crystal structure and lattice dynamics of solid CS_2. E.Burgos (Div. Fisica des Solido, Comision Nacional de Energia Atomica, Buenos Aires, Argentina), R.Righini.
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.584-90 (22 April 1983).
Good agreement with the experimental structure and with the observed lattice frequencies of crystalline CS_2 is obtained using an intermolecular potential consisting of an electrostatic part and of an anisotropic atom-atom potential. The role of anisotropic short-range interactions in the statics and dynamics of linear-molecule crystals is discussed. (20 refs.)

66945 The chemical bonding in lithium metaborate, $LibO_2$. Charge densities and electrostatic properties. A.Kirfel, G.Will (Mineralogisches Inst. Univ. Bonn, Bonn, Germany), R.F.Stewart.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.175-85 (1 April 1983).
The room-temperature electron density distribution in $LiBO_2$ has been studied by X-ray diffraction experiments up to $s=1.08$ Å^{-1}. Conventional structure refinements both with HF scattering factors for the neutral atoms and with the monopole parts of generalized scattering factors (GSF) calculated from the diatomic-molecule wavefunctions of LiO and BO yielded $R_w^{HF}=0.0251$ and $R_w^{GSF}=0.0192$ for 1266 observed reflections. (23 refs.)

66946 The structure of potassium-exchanged heulandite at 293, 373 and 593K. E.Galli, G.Gottardi (Istituto di Mineralogia e Petrologia, Univ. di Modena, Modena, Italy), H.Mayer, A.Preisinger, E.Passaglia.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.189-97 (1 April 1983).
Single crystals of heulandite were potassium-exchanged to reach a chemical composition of $(Na_{0,10}K_{8,57}\text{-}Ba_{0,04})(Al_{9,31}Si_{26,83})O_{72}.19.56H_2O$. Thermogravimetry up to 593K of such single crystals was carried out concurrently with the X-ray diffraction measurements of one single crystal at 293, 373 and 593K. At 593K the sample was fully dehydrated. The crystal structures were refined by least squares to R_w values of 0.073 (293K), 0.090 (373K) and 0.112 (593K). [Crystal data for the first structure (293K): *C2/m*, $a=17.767(7)$, $b=17.958(7)$, $c=7.431(1)$ Å, $\beta=115.93(2)°$.] The crystal structure at 593K is essentially in agreement with that at 293K of a single crystal previously heated to 573K in an evacuated and sealed glass capillary. The process of dehydration is represented by these crystal structure determinations showing the change of the water molecules and the positions of the K^+ ions as well as the deformation of the silicate framework. (13 refs.)

66947 Analysis of the incommensurate structure in $Sr_2Nb_2O_7$ by electron microscopy and convergent-beam electron diffraction. N.Yamamoto (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA), K.Ishizuka.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.210-16 (1 April 1983).
The incommensurate lattice modulation in $Sr_2Nb_2O_7$ has been studied by the high-resolution dark-field technique, which revealed curved lattice fringes showing the irregularity of the modulation wave inside the crystal on a relatively large scale. Convergent-beam electron diffraction patterns were analyzed to derive the symmetry of the incommensurate lattice modulation and that of the fundamental lattice. The results were compared with the previously proposed atom-displacement model. (17 refs.)

66948 Structure and crystal chemistry of mixed-valence ternary platinum oxides: $MnPt_3O_6$, $CoPt_3O_6$, $ZnPt_3O_6$, $MgPt_3O_6$, and $NiPt_3O_6$. K.B.Schwartz, J.B.Parise, C.T.Prewitt (Dept. of Earth & Space Sci., State Univ. of New York, Stony Brook, NY, USA), R.D.Shannon.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.217-26 (1 April 1983).
The structures of the mixed-valence series of MPt_3O_6 compounds with approximate compositions $MnPt_3O_6$, $CoPt_3O_6$, $ZnPt_3O_6$, $MgPt_3O_6$, and $NiPt_3O_6$ have been refined from neutron powder diffraction experiments. The first four were isostructural with the prototype *C*-centered $CdPt_3O_6$, containing a rigid framework of planar PtO_4 and octahedral PtO_6 groups and a distorted eight-coordinated counterion site consisting of two interpenetrating rectangular planes. Further distortions of the counterion site in $NiPt_3O_6$ caused a change in symmetry to a primitive lattice, thereby distinguishing its structure from those of the other known MPt_3O_6 compositions. The presence of some cation disorder and vacancies was established from refinements of site occupancies constrained by known values of counter-ion content determined by independent chemical analysis. The $MnPt_3O_6$ structure was refined in *Cmmm* with $Z=2$ [$a=7.152(1)$, $b=10.045(1)$, $c=3.1476(3)$ Å] by the Rietveld profile technique to a final $R_{wp}=0.171$ for data collected at $\lambda=1.30$ Å. The $CoPt_3O_6$, $ZnPt_3O_6$, and $MgPt_3O_6$ structures were also refined in *Cmmm* using integrated intensities for data collected at $\lambda=2.46$ Å to $R_w=0.041$, 0.046, and 0.076, respectively. The $NiPt_3O_6$ structure was refined in *Pbam* with $Z=2$ [$a=7.123(1)$, $b=9.933(1)$, $c=3.100(1)$ Å] from similar data to a $R_w=0.050$. (28 refs.)

66949 Protonic solid electrolytes: a single-crystal neutron diffraction study of ammonium-hydronium β''-alumina. J.O.Thomas (Inst. of Chem., Univ. of Uppsala, Uppsala, Sweden), G.C.Farrington.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.227-35 (1 April 1983).
The structure and ionic distribution in the conducting plane of ammonium-hydronium β''-alumina, a solid electrolyte with high protonic conductivity, have been determined by single-crystal neutron diffraction. The composition, constrained in the refinement to neutrality, is: $(NH_4^+)_{1.56}(H_3O^+)_{0.19}Mg_{0.75}Al_{10.25}O_{17}\text{-}(H_2O)_{0.25}$, with three such units per unit cell. The hexagonal cell dimensions are: $a=5.6310(4)$, $c=34.378(6)$ Å, $V=944.0$ Å^3, for the rhombohedral space group *R3m*. $R(F^2)=0.035$, $R_w(F^2)=0.049$ for 1505 reflections. The structure comprises spinel blocks of Al atoms, tetrahedrally or octahedrally coordinated to O atoms. One of the two tetrahedrally coordinated Al^{3+} sites is occupied to 37% by Mg^{2+} to provide charge compensation in the structure. The site Al(2) is near the centre of the spinel block ($z\sim0$). The NH_4^+ ions occupy 6(*c*) sites in the

conducting planes which interleave the spinel blocks at $z=\pm{}^1/_6$ and ${}^1/_2$, with a partial site occupation of 78%. When such sites are not occupied by NH_4^+ ions, they are occupied by either an H_2O molecule or an H_3O^+ ion, with a statistical ratio between the two of 4:3. The distance from the O atom of the H_2O molecule or H_3O^+ ion to the $\bar{3}$ axis is 0.84(1) Å. Site-occupation considerations suggest a Grotthus-type mechanism for proton transfer involving three components: rotational translation of H_3O^+ and H_2O, and proton transfer from H_3O^+ to H_2O. (25 refs.)

66950 $[Fe_4Te_8]$-cluster $Cs_7Fe_4Te_8$; a new type of structure in ternary metal chalcogenides. W.Bronger, M.Kimpel, D.Schmitz (Inst. fur Anorganische Chem., Tech. Hochschule Aachen, Aachen, Germany).

Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.235-8 (1 April 1983). In German.

The crystal structure of $Cs_7Fe_4Te_8$ has been determined by single-crystal X-ray techniques. The crystals are monoclinic, $C2/c$, with $a=20.569(6)$, $b=9.306(3)$, $c=18.235(4)$ Å, $\beta=117.48(2)°$ and $Z=4$. Full-matrix least-squares refinement of 1595 independent observed reflexions gave a conventional R index of 0.038. The atomic arrangement $[Cs_7(Fe_4)]Te_8$ corresponds to that in cesium chloride. The outstanding feature of the crystal structure is the occurrence of isolated $[Fe_4Te_8]$ clusters, in which the Fe atoms are tetrahedrally surrounded by Te atoms and four tetrahedra are mutually linked such that each is joined to the others via three edges, corresponding to $[FeTeTe_{3/3}]_4$. (7 refs.)

66951 The charge density distribution in $LiAlB_{14}$. T.Ito, I.Higashi (Inst. of Phys. & Chem. Res., Saitama, Japan).

Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.239-43 (1 April 1983).

The charge density distribution in $LiAlB_{14}$ has been investigated by X-ray diffractometry. Population analysis of valence electrons with a least-squares method ($R=0.019$, $R_w=0.035$ for 1895 reflections) resulted in a net charge distribution of Li^{1+}-$(Al^{1.7+})_{0.96}(B_{12})^{1.2-}.2B^{0.7-}$. On the other hand, charge integration around the metal atoms within the spheres of radii 1.08 and 1.15 Å for Li and Al respectively gave net charges of $Li^{0.7+}$ and $Al^{1.5+}$. These results indicate that the structure of $LiAlB_{14}$ is stabilized by charge transfer from the metals to the electron-deficient boron framework. Deformation maps through the triangular faces of the B_{12} icosahedron showed accumulation of charges at the centers of the faces, which is a characteristic feature of delocalized three-center bonds. The bonding-electron peaks of the strained intericosahadral B-B bonds are not located on the bonds but shifted toward the pseudo fivefold axes of the icosahedron, indicating that the bonds are bent. Around the metal atoms prominent peaks were observed which are much sharper and closer to the atomic centers than expected for the valence electrons of free metal atoms. (9 refs.)

66952 Refinement of the crystal structure of arsenic telluride As_2Te_3. A.S.Kanishcheva, Yu.N.Milhailov, A.P.Chernov (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).

Inorg. Mater. (USA), vol.18, no.6, p.796 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.949-52 (June 1982). [received: Feb. 1983]

A three-dimensional diffractometer study and full-matrix anisotropic refinement using the method of least squares is used to describe the structure of As_2Te_3 crystals which had been known previously only from two-dimensional data. Analysis of the details concerning bond lengths and bond angles reveals features of the coordination of nonequivalent arsenic atoms. Different extents of activity and localization of the unshared electron pair at these atoms were proposed. (6 refs.)

66953 Crystal, molecular, and electronic structures of tetrasulfur dinitride, S_4N_2. T.Chivers, P.W.Codding, W.G.Laidlaw, S.W.Liblong, R.T.Oakley, M.Trsic (Dept. of Chem., Univ. of Calgary, Calgary, Alberta, Canada).

J. Am. Chem. Soc. (USA), vol.105, no.5, p.1186-92 (9 March 1983).

A simple method for obtaining high-purity S_4N_2 crystals is described. The crystal and molecular structure of S_4N_2 at $-100(5)°C$ has been determined by X-ray diffraction. Crystal of S_4N_2 are tetragonal, space group $P4_2nm$, $a=b=11.146$ (4) Å, $c=3.773$ (1) Å, $V=468.7$ Å^3, and $Z=4$. The refined structure ($R=0.021$) shows the molecule to be a six-membered ring with the nitrogen atoms in the 1,3-positions. The molecule adopts a half-chair conformation with the central sulfur of the trisulfide unit lifted out of the plane of the remaining five atoms, producing a dihedral angle of 54.9°. MNDO and ab initio Hartree-Fock-Slater SCF calculations on a variety of model S_4N_2 structures show that the observed conformation is preferred by 6-10 kcal mol.$^{-1}$ over a planar structure. The electronic structure and bonding are discussed on the basis of the HFS calculations on the crystal structure geometry and a related planar model. UV-visible absorption and vibrational spectra are also reported. (42 refs.)

66954 X-ray diffraction data from the high pressure phase of AlSb. M.Baublitz,Jr., A.L.Ruoff (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).

J. Appl. Phys. (USA), vol.54, no.4, p.2109-10 (April 1983).

Powder diffraction data from a high pressure phase of AlSb have been obtained using the energy dispersive diffraction technique with synchrotron radiation from the Cornell High Energy Synchrotron Source. The diffraction pattern of the high pressure phase of AlSb has been indexed with an orthorhombic unit cell. (11 refs.)

66955 Structural studies of low temperature ice I_h using a central force potential model. P.Deutsch (Dept. of Phys., Pennsylvania State Univ., Monaca, PA, USA), B.N.Hale, R.C.Ward, D.A.Reago,Jr..

J. Chem. Phys. (USA), vol.78, no.8, p.5103-7 (15 April 1983).

The revised central force potentials of Stillinger and Rahman [J. Chem. Phys., vol.68, p.666 (1978)] are used to study the binding energy, structure and multipole moments of a periodic ice I_h sample with a unit cell of 192 water molecules. The initial configuration for the unit cell has each oxygen in a wurtzite structure and intramolecular H-O-H angles symmetrically positioned in the tetrahedral O-O-O angles. Hydrogens are placed such that the total dipole moment for the unit cell is zero and the diagonal quadrupole moments are small ($\lesssim 10^{-28}$ esu cm^2). Subject to these restrictions, a static energy minimization on the periodic ice crystal yields an optimal O-O separation, intramolecular O-H distance, and intramolecular H-O-H angle of 2.78, 0.972 A, and 101.0°, respectively. Starting from this idealized wurtzite configuration, Metropolis Monte Carlo runs on the periodic system are made at 20 and 200K. At 20K, the equilibrated system has an average intermolecular potential energy per molecule of -15.2 kcal/mol and structure factors which have decreased to about 80% of the initial values. The dipole moment for the unit cell is $\simeq 3$ D. The equilibrated system at 200K appears to be modified only by temperature dependent vibrational effects. (14 refs.)

66956 Neutron scattering study on distribution of cations in α-AgI-type superionic conductors. S.Hoshino (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan), T.Sakuma, H.Fujishita, K.Shibata.

J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1261-9 (April 1983).

Neutron diffuse scattering from powder samples of α-AgI type superionic conductors AgI, Ag_3SI and Ag_2S was measured using a triple-axis spectrometer with a fixed position of the energy analyzer so as to measure only the elastic scattering caused by a disordered distribution of cations. The disorder scattering curves thus obtained were analyzed under the assumption that Ag atoms distribute over crystallographic 12(d) sites among the BCC lattice formed by anions, and probability functions α_n for a simultaneous occupation in the n-th neighbor sites were obtained. The results are discussed in comparison with the pair correlation function $g_{Ag-Ag}(r)$ obtained theoretically as well as by the analysis of X-ray diffuse scattering based on a liquid-like distribution model. The liquid phase of AgI was also studied by the same neutron technique and the results are discussed together with those for the solid phase. (22 refs.)

66957 Preparation and properties of some curium silicides. F.Weigel, R.Marquart (Radiochem. Abteilung, Insts. fur Anorganische Chem., Univ. Munchen, Munchen, Germany).

J. Less-Common Met. (Switzerland), vol.90, no.2, p.283-90 (April 1983).

Curium monosilicide (CmSi), curium sesquisilicide (Cm_2Si_3) and curium disilicide ($CmSi_2$) were prepared by the reduction of curium trifluoride with stoichiometric amounts of elemental silicon in vacuo at 1260°C (CmSi), 1200°C (Cm_2Si_3) and 1260°C ($CmSi_2$). CmSi was obtained as a black coke-like mass isomorphous with LaSi and CeSi. It was found to have an orthorhombic lattice with $a=5.954\pm0.089$ Å, $b=8.278\pm0.126$ Å and $c=3.914\pm0.044$ Å (space group, $Pnma$) with four formula units per unit cell and $D_x=9.36$ g cm^{-3}. Cm_2Si_3 was obtained as a bright silvery crystalline material with filamentary grains. It was found to have a hexagonal lattice of the β-$PuSi_2$ type with $a=3.870\pm0.008$ Å and $c=4.145\pm0.021$ Å (space group, $P6/mmm$) with two formula units per unit cell and $D_x=8.84$ g cm^{-3}. $CmSi_2$ formed silvery platelets with a tetragonal α-$ThSi_2$-type structure with $\alpha=3.963\pm0.012$ Å and $c=13.720\pm0.033$ Å (space group, $I4_1/amd$) with four formula units per unit cell and $D_x=9.26$ g cm^{-3}. (9 refs.)

66958 The structure of dehydrated zeolite 3A (Si/Al=1.01) by neutron profile refinement. J.M.Adams, D.A.Haselden (Edward Davies Chem. Labs., Univ. Coll. of Wales, Aberystwyth, Wales).

J. Solid State Chem. (USA), vol.47, no.2, p.123-31 (April 1983).

A neutron powder diffraction study of a dehydrated commercially available potassium exchanged zeolite A (Linde 3A) has shown that the diffraction pattern can be indexed in cubic space group $Fm3c$. For this sample there is 63% exchange of potassium for sodium ($K^+/Na^+=1.69$). Data collected at a neutron wavelength of 2.98 Å shows no evidence of rhombohedral distortion and suggests that the assignment of space group $Fm3c$ is correct. The final structural model is closely analogous to that found for dehydrated sodium zeolite A (Adams et al., 1982; Pluth and Smith, 1980). Unusual features of previous refinements of potassium containing zeolite A samples, i.e. 'zero coordinate' cations (Leung et al., 1979) or potassium inside the β-cage (Pluth and Smith, 1979) have not been found. Refinements using the same 1.9 Å neutron powder diffraction data were also obtained with the models of Leung et al. and Pluth and Smith, 1979, as starting points (denoted LKSM and PS, respectively) and comparison is made with these. The final R factors for the three refinements were R_{pw} (Cheetham and Taylor, 1977)=10.24% for the model presented here, $R_{pw}=10.38\%$ (PS model), and $R_{pw}=10.61\%$ (LKSM model). (32 refs.)

66959 $VOCl_3$: crystallization, crystal structure, and structural relationships: a joint X-ray and ^{35}Cl-NQR investigation. J.Galy, R.Enjalbert, G.Jugie (Lab. de Chimie de Coordination, CNRS, Toulouse, France), J.Strahle.

J. Solid State Chem. (USA), vol.47, no.2, p.143-50 (April 1983).

Cooling of $VOCl_3$ below its melting point (196K) yields an amorphous phase, which transforms into the crystalline state upon further cooling. The crystallization is accompanied by a remarkable change in color from pale yellow to deep orange. A single crystal has been grown from the amorphous phase. $VOCl_3$ crystallizes in the orthorhombic system, space group $Pnma$, with lattice parameters $a=4.963(1)$, $b=9.140(4)$, $c=11.221(5)$ Å at 133K; $Z=4$. The ^{35}Cl-NQR experiments show two signals at approximately 11.4 MHz of intensity 2:1, which implies two different crystallographic sites for chlorine atoms, in agreement with the centrosymmetric space group $Pnma$. The crystal structure exhibits isolated tetrahedral molecules of $VOCl_3$ lying on a mirror plane and stacked with their V-O axes along [100] to form trigonal prismatic columns. A close relationship exists with the structure of $AsBr_3$, in which the lone pair occupies the position corresponding to the oxygen atoms. (13 refs.)

66960 The hollandite-related structure of $Ba_2Ti_9O_{20}$. G.Grzinic, L.A.Bursill (School of Phys., Univ. of Melbourne, Parkville, Victoria, Australia), D.J.Smith.

J. Solid State Chem. (USA), vol.47, no.2, p.151-63 (April 1983).

The crystal structure of $Ba_2Ti_9O_{20}$ has been determined by comparison of experimental high-resolution electron micrographs with images simulated using structural models deduced from the micrographs in conjunction with crystallochemical principles. The structure consists of lamellae of hollandite-type structure alternating with $BaTiO_3$-like units, which effectively immobilize the Ba ions. This material should be relatively more leach resistant to attack by aqueous sodium chloride solutions. The structure determination clarifies the observation that this material has unique properties as a microwave resonator, compared with other barium and alkali titanate structures. (18 refs.)

66961 Synthesis, characterization, and crystal structure of a new truly one-dimensional compound: PV_2S_{10}. R.Brec, G.Ouvrard, M.Evain, P.Grenouilleau, J.Rouxel (Lab. de Chimie des Solides, Nantes, France).

J. Solid State Chem. (USA), vol.47, no.2, p.174-84 (April 1983).

PV_2S_{10} was obtained by heating the elements in stoichiometric proportions at 490°C in evacuated Pyrex tubes. The crystal symmetry is monoclinic, space group $P2_1/c$, with unit cell parameters $a=12.734(8)$ Å, $b=7.349(7)$ Å, $c=23.662(4)$ Å, $\beta=95°22(1)$, $V=2205(4)$ Å^3, and $Z=8$. The structure was solved from 2269 independent reflexions, and anisotropic least squares refinement gave $R=0.036$ with 236 variables. The structure can be described as made of $[V_2S_{12}]$ units forming endless chains, themselves linked, two by two, by $[PS_4]$ tetrahedra. In these units each vanadium is surrounded by eight sulfur atoms (mean $d_{V-S}=2.459$ Å) arranged in a distorted bicapped triangular prism. Two of these prisms shared a rectangular face to form $[V_2S_{12}]$ groups, in which intercationic distances implied vanadium-vanadium bonds (mean $d_{V-V}=2.852(2)$ Å). Between the infinite double chains, only S-S weak van der Waals bonds exist. More than two-thirds of the sulfur atoms are present as $[S\text{-}S]^{-II}$ pairs, (mean $d_{S-S}=2.015$ Å); the rest are S^{-II} anions. (12 refs.)

66962 A crystal chemical study of stishovite. R.J.Hill (Div. of Mineral Chem., CSIRO, Port Melbourne, Victoria, Australia), M.D.Newton, G.V.Gibbs.

J. Solid State Chem. (USA), vol.47, no.2, p.185-200 (April 1983).

The crystal structure of stishovite, SiO_2, $a=4.1773(1)$, $c=2.6655(1)$ Å, space group $P4_2/mnm$, with $Z=2$, has been refined with 217 graphite-monochromatized Mo$K\alpha$ data (2θ max$=120°$) to $R=0.012$ ($R_W=0.014$). Electron deformation density maps show a modest accumulation of charge density ascribed to partial covalent bonding in both the equatorial and axial bonds together with a delocalization of density in and around the shared octahedron edges with the shorter equatorial bonds showing higher peaks (0.47 e Å^{-3}) than the longer axial bonds (0.29 e Å^{-3}). Net atomic charges for Si and O determined by a population and κ refinement by varying the occupancy and shape of their valence shells are +1.71 and −0.86(15)e, respectively. The observed structural distortions and charge distributions conform with the results of ab initio molecular orbital calculations undertaken on molecules designed to mimic the local geometry of the structure of stishovite. The Si-O bond length (1.73 Å) calculated for a neutral molecule with 6-coordinatd Si is slightly shorter than that observed on the average (1.76 Å) for silicates and molecular crystals with 6-coordinated Si. In addition, the calculated geometrical parameters of two edge-sharing octahedra agree to within ~5% of the observed geometry of stishovite. The calculated charge on Si is indicated to increase with coordination number and bond length in agreement with the larger net charge recorded for stishovite as compared with that recorded for α-quartz, $Q(\mathrm{Si})=+1.0\ e$. Observed deformation maps are compared with theoretical ones calculated in the equatorial plane of the 6-coordinated molecule using molecular orbital theory with a split valence s,p basis supplemented with d-type polarization functions on Si. (66 refs.)

66963 The crystal structure of $CsYb_3F_{10}$: refinement in a higher-symmetry space group. R.E.Marsh (Arthur Amos Noyes Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Solid State Chem. (USA), vol.47, no.2, p.242-3 (April 1983).
The author begins by outlining the results of Aleonard et al. (1982) for the crystal structure of $CsYb_3F_{10}$. These authors were unable to refine in Pmcm below an R of 0.09 and reported that the isotropic temperature factors became unacceptably large. They therefore chose the monoclinic space group Pc for the $CsYb_3F_{10}$ structure. This refinement experience is different for the author who reports that the Pmcm structure leads to a quite satisfactory R and to no unusual temperature factors. (3 refs.)

66964 Thermal stability and crystal structure of the double molybdate $Li_7Ho_3(MoO_4)_8$. E.N.Ipatova, R.F.Klevtsova, L.P.Solov'eva, P.V.Klevtsov (Inst. of Inorganic Chem., Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.418-22 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.115-19 (May-June 1982). [received: Feb. 1983]
The compound $Li_7Ho_3(MoO_4)_8$ undergoes thermal decomposition at 725°C to the double molybdate $LiHo(MoO_4)_2$ (solid) and normal Li_2MoO_4 (liquid). It crystallizes in a triclinic unit cell with parameters: $a=5.191$, b=6.729, c=10.729 Å, $\alpha=108.10$, $\beta=100.19$, γ-66.31°, space group P1, Z=0.5. The crystal-chemical content of the cell is: $Li_3(Ho_{0.75}Li_{0.25})_2(MoO_4)_4$. The crystal structure is made up of layers of eight-apex M polyhedra (M=0.75 Ho+0.25 Li), joined through shared edges and shared apices with the Mo tetrahedra surrounding them. The layers are parallel to (001) and are jointed to one another through Li atoms. The structure is closely related to the scheelite structure. (9 refs.)

66965 X-ray investigation of electron-irradiated quartz. D.Grasse, D.Muller, H.Peisl, C.Laermans (Sektion Phys., Ludwig-Maximilians Univ., Munchen, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.119-22 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
An X-ray study on electron-irradiated quartz single crystals (dose 1.8×10^{20} e/cm^2), on which thermal conductivity measurements had been made before, showed within experimental error no scattering of amorphous regions, no lattice parameter change and no diffuse scattering intensity close to Bragg peaks. In contrast to similar earlier measurements on neutron-irradiated quartz single crystals, the results of thermal conductivity cannot be explained by amorphous regions distorting the lattice. (9 refs.)

66966 The crystal structure of erbium pentaphosphate. Lin Yonghua, Hu Ninghai, Zhou Qinglian, Shi Endong, Wang Mingyi, Liu Shuzhen, Wu Shixue (Changchun Inst. of Appl. Chem., Acad. Sinica, Beijing, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1182-5 (Nov. 1982). [received: April 1983] (3 refs.)

66967 Static and structural properties of III-V zincblende semiconductors. S.Froyen, M.L.Cohen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.561-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The pseudopotential method within the local density approximation is used to investigate the static and structural properties of some III-V zincblende semiconductors. The results for lattice constants and bulk moduli agree within a few percent with experimental values. Comparisons of calculated total energies as a function of volume and structure yield information about solid-solid structural phase transformations. At high pressures, the results indicate that metallic rocksalt and β-Sn structures have lower energy than zincblende. Other structures (e.g., CsCl and NiAs) are also investigated. (10 refs.)

66968 Structure of α- and β-Si_3N_4 observed by 1 MV electron microscopy. K.Hiraga, K.Tsuno, D.Shindo, M.Hirabayashi, S.Hayashi, T.Hirai (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Philos. Mag. A (GB), vol.47, no.4, p.483-96 (April 1983).
Crystal structures of Si_3N_4 prepared by chemical vapour deposition (CVD) have been observed on the atomic scale by high-voltage, high-resolution electron microscopy. Many-beam images with [001] axial illumination exhibit the projected potential with trigonal and hexagonal symmetry for α- and β-Si_3N_4 respectively at thicknesses of less than about 10 nm. The image contrasts are discussed on the basis of multislice calculations as a function of crystal thickness and objective lens defocus. Excellent agreement is obtained between the observed and calculated images for both crystals. An atomic model of a structure defect in β-Si_3N_4 is proposed directly from the images. (14 refs.)

66969 Charge distribution from least-energy structure in Ca-Mg orthosilicates. M.Catti (Cattedra di Cristallochimica, Univ. di Milano, Milano, Italy), G.Ivaldi.
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.160-6 (1983).
Calcium-olivine, γ-Ca_2SiO_4, larnite, β-Ca_2SiO_4, merwinite, $Ca_3Mg(SiO_4)_2$, and monticellite, $CaMgSiO_4$, are considered. According to a rigid oxyanion scheme, eulerian orientation angles of the SiO_4 tetrahedra and translation coordinates of Ca and Si atoms are specified as structural variables τ_k. All derivatives of the static energy (Born model) contain atomic charges and repulsive parameters as unknowns; the minimum energy conditions $\partial E_L/\partial\tau_k=0$ yield 34 equations which are solved by a least-squares method. The set of energy parameters fitting structural properties of all four phases together is: $z_{Ca}=1.50$, $z_0=-1.10$ e, $r_{Ca}=1.05$, $\rho=0.25$ Å; the Mg charge was fixed at 1.38 e, from a previous study on forsterite. An average shift of 0.04 Å is observed between experimental and least-energy calculated atomic positions. Results are compared with those of Mg_2SiO_4, where the fit was based both on thermoelastic and on structural properties. If no charge values were fixed 'a priori', ratios between charges could be determined by fitting them to structural data only. (17 refs.)

66970 Composition dependence of the lattice constant of $Ge_{2x}(GaAs)_{1-x}$ solid solutions. M.E.Raikh, V.E.Umanskii (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1298-300 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2011-14 (Nov. 1982). [received: April 1983]
The anomalous composition dependence of the lattice constant of $Ge_{2x}(GaAs)_{1-x}$ solid solutions is explained on the assumption that GaAs represents 'charged' Ge. (8 refs.)

66971 The effect of magnesium content on the structure and properties of synthetic smectites. J.Masar, V.S.Fajnor (Dept. of Inorganic Chem., Comenius Univ., Bratislava, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.1, p.45-53 (1983). In Czech.
Hydrothermal synthesis (temperature 300°C, pressure 8.8 MPa, time 6 days) was used for preparing 6 specimens from mixtures of X-ray-amorphous oxides in weight ratios $SiO_2:Al_2O_3:MgO=8:2:M$, where $M=1$, 2, 3, 4, 5 and 6 mole. Measurements of X-ray diffractions from planes 060 and the courses of DTG curves in the temperature interval 500-1000°C indicated that on increasing the MgO content, the dioctahedral smectite is supplemented with a gradually increasing proportion of smectite with a trioctahedral arrangement of structure. At a relatively high MgO content (about 25%), hydrothermal synthesis yeilds trioctahedral smectite. An increase in MgO content in dioctahedral specimens leads to gradual substitution of aluminium at the octahedron centres by magnesium, which results in an increase in the d_{060} value and an increase in the cation exchange capacity. However, the temperature of the dehydroxylation peak on both DTA and DTG curves remains in the interval 700-750°C. Dehydroxylation of synthetic trioctahedral smectics is terminated in the relatively narrow temperature interval of 850-900°C. An increase in the MgO content leads to a decrease of the melting temperature of the specimens in question. (6 refs.)

An analytical method for indexing X-ray powder patterns of monoclinic substances ....See Entry 66780

Weak asymmetry in β-Si_3N_4 as revealed by convergent-beam electron diffraction ....See Entry 66918

Some additional changes in space groups in published crystal structures ....See Entry 66919

A simultaneous study of lattice expansion and swelling in proton-bombarded GaP single crystals ....See Entry 67060

Neutron, X-ray and lattice dynamical studies of paraelectric Sb_2S_3 ....See Entry 67136

TEM image contrast from clustering in Ga-In containing III-V alloys ....See Entry 67213

Thermal expansion of yttrium vanadate ....See Entry 67243

Lattice thermal expansion of silver metaperiodate ....See Entry 67245

Composition of the highly conducting compound in the RbCl-CuCl system ....See Entry 67254

Pressure and composition dependence of the electrical conductivity of iron-rich synthetic olivines to 200 kbar ....See Entry 67613

Transport and structural properties of the silver intercalation complexes of 2H-TaS_2 ....See Entry 67708

Magnetic susceptibility of $La_{1-x}Nd_xTlO_3$ system ($0.0\leq x\leq1.0$) [and synthesis and X-ray characterisation] ....See Entry 67899

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, X=O, S, Se ....See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te ....See Entry 67904

Mossbauer and X-ray study of $FeP_{0.85}Si_{0.15}$ ....See Entry 68101

Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine ....See Entry 68198

Spectroscopic properties of nickel(II) ion in loaded mordenite ....See Entry 68252

Multiple-scattering effects in EXAFS spectroscopy of oxygen-bridge iron complexes. Possibility of angle determination by EXAFS analysis ....See Entry 68359

Preparation of TlP_xS_{1-x} and investigation of physicochemical properties ....See Entry 68423

Synthesis of chalocgenides with the composition $A^I{}_2B^{VI}$ and crystal structure of Rb_2Te_3 and Cs_2Te_3 ....See Entry 68424

Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$ ....See Entry 68433

Synthesis and physical properties of $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$ ...See Entry 68434

Synthesis and properties of $La_{1-x}K_xVO_3$ solid solutions with the perovskite structure ....See Entry 68465

Study of the SnO_2-Ta_2O_5 system and preparation of tin tantalates and niobates ....See Entry 68522

Stabilization of the compound $12Ca0.7Al_2O_3$ and its derivatives ....See Entry 68524

The system SrO-Nb_2O_5 ....See Entry 68525

Properties of polycrystalline indium oxide in the air and in vacuum ....See Entry 68568

61.65 SPECIFIC STRUCTURE OF ORGANIC COMPOUNDS

66972 Molecular and crystal structure of ANCAOLAN (crystal I and crystal II). Lin Xio-Yun, Zhang Shu-De (Inst. of Biophys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.273-9 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
ANCAOLAN is a weed kiler, its series product, the crystal I($C_{11}H_{16}N_2O_4$ PSCL) and crystal II($C_{12}H_{19}N_2O_4$ PS), both belong the monoclinic system, with space group $P2_1/c$. There are four molecules in a unit cell. The crystal paramters are: crystal I $a=8.575$ Å, $b=26.541$ Å, $c=7.063$ Å, $\beta=94.744°$; crystal II $a=8.575$ Å, $b=26.538$ Å, $c=7.073$ Å, $\beta=93.819°$. For the crystals I and II the three-dimensional intensity data were collected by using PW-1100 four-circle diffractometer and the numbers of independent diffractions are 3123 and 3166 respectively. Their structures were solved by direct method and refined by full matrix least-squares method. Their final R-factors are 0.10 and 0.11 respectively. The plane of nitro is perpendicular to the plane of

benzene ring. The weed killing effect of crystal II is better than that of the crystal I. (2 refs.)

66973 Determination of crystal structure of α-chloro-n-sec-butyl-cinnamide. Zheng Chao-De, Gu Yuan-Xin (Inst. of Phys., Acad. of Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.280-4 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
α-chloro-n-sec-butyl-cinnamide crystal (trans) belongs to orthorhombic system. The space group is $D_{2h}{}^{15}$-P_{bca} with either molecules in a cell of dimension a=18.842 (0.006) Å, b=14.076 (0.006) Å, c=10.077 (0.003) Å. The intensity data were collected on RAA-IIS four-circle diffractometer. The number of independent reflexions is 929. The structure was solved by direct method (MULTAN=90). Refinement of structuré parameters was achieved by block-matrix least-squares method R=0.088. (no refs.)

66974 Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4. A.I.Prokhvatilov, A.P.Isakina.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.419-28 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The lattice parameters and thermal expansion are X-ray investigated on polycrystalline methane. The volume jumps occurring during the phase transition and melting are estimated. Using the obtained thermal expansion coefficients, heat capacities C_V and Gruneisen constants are calculated. The contributions to heat capacity of translational and rotational motion of molecules are analysed. The density, volume and enthalpy of the equilibrium vacancy formation are found through a comparison of X-ray and dilatometric thermal expansion coefficients in the vicinity of the melting temperatures of CH_4. The characteristics obtained are close to the values observed for monovacancies in inert gas crystals. (35 refs.)

66975 1,2-dibenzyl- and 1,2-diaryltetrakis(dimethylamido)dimolybdenum and -ditungsten compounds: $M_2R_2(NMe_2)_4$ (M≡M). Structural effects of Me_2N-to-M π bonding. M.J.Chetcuti, M.H.Chisholm, K.Folting, D.A.Haitko, J.C.Huffman, J.Janos (Dept. of Chem., Indiana Univ., Bloomington, IN, USA).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1163-70 (9 March 1983).
The authors have synthesised 1,2-$M_2R_2(NMe_2)_4$ compounds where R=benzyl and aryl. The conformations and other structural aspects of these new compounds provided unequivocal evidence for the dominant role of Me_2N-to-M π bonding in these types of complexes. (22 refs.)

66976 X-ray investigation of the high temperature structure of $(CH_3)_3NHCdCl_3$. S.Kashida, K.Sano, T.Fukumoto, H.Kaga (Dept. of Phys., Niigata Univ., Niigata, Japan), M.Mori.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1255-60 (April 1983).
The structural phase transitions in a linear chain compound $(CH_3)_3NHCdCl_3$ were investigated by an X-ray photographic method. It was found that the high temperature phase above 374K belongs to the orthorhombic Pbnm (Z=8) rather than to the hexagonal $P6_3/m$ (Z=6) which was proposed by Chapuis and Zuniga. The structure of this high temperature phase was argued to be characterized by an orientationally disordered state of the trimethyl ammonium ions. An analogy to the triangular Ising lattice is also refered.

66977 Tentative reconstitution of the crystal structure of benzene, at −3°C, by a molecular interaction analysis taking thermal vibration coefficients into account. B.Rerat, C.Rerat (Lab. de Cristallographie, CNRS, Bellevue, France).
J. Chim. Phys. & Phys.-Chim. Biol. (France), vol.80, no.2, p.183-9 (Feb. 1983). In French.
The work follows a previous study which had permitted a theoretical reconstitution of the approximate crystalline structure of benzene, at −3°C, by a classical dynamic analysis of molecular interactions. By a refinement of the initial model, it also became possible to calculate the thermal anisotropic vibration coefficients. The new atomic positions are not in better agreement with those obtained by X-ray diffraction; a more systematic exploration of the possibilities of the method is thus-implied. (12 refs.)

66978 Structure of anions and neutral molecules of selenazolidine-2,4-dione. I.V.Levshin, M.M.Kaganskii, K.A.V'yunov, A.A.Tsurkan, A.I.Ginak, A.A.Espenbetov, A.I.Yanovskii, Yu.T.Struchkov.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.813-16 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.103-7 (July 1982). [received: March 1983]
The individual bands in the IR spectra of selenazolidine were interpreted by using the spectrum of d_3-selenazolidine-2,4-dione (III), and also the data on X-ray diffraction analysis of selenazolidine-2,4-dione (I). The IR spectra were recorded on the Perkin-Elmer 283 spectrophotometer. The solid samples were prepared in the form of suspensions in mineral oil. The spectra of the solutions were measured in CaF_2 cuvettes at a concentration of C=0.01 mole/liter. The cell parameters and intensities of 750 independent reflections with $F^2 \geq 3\sigma$ were measured on an automatic Hiller-Watts 4-disk diffractometer. (14 refs.)

Molecular structure, vibrational spectra and normal coordinate analysis of S-methyl dithiocarbamate .... See Entry 65988

An analytical method for indexing X-ray powder patterns of monoclinic substances .... See Entry 66780

Some additional changes in space groups in published crystal structures .... See Entry 66919

Orientational disorder of complex cations and anions in high-temperature phases of ionic compounds. Results of three-dimensional electron density calculations on the basis of X-ray diffraction data .... See Entry 66939

Polymorphism in organo-metallic bidimensional structures: the bis (n-octylammonium) tetrachlorocadmate .... See Entry 67191

High-resolution solid-state nuclear magnetic resonance and X-ray structure study of choline chloride, bromide, and iodide .... See Entry 68084

Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine .... See Entry 68198

61.70 DEFECTS IN CRYSTALS

(see also 61.80 Radiation damage, 62. Mechanical and acoustic properties, 71.55 Impurity and defect levels, 76.30M EPR of colour centres and other defects, 78.50 Impurity and defect absorption in solids, 81.40 Treatment of materials)

66979 A mechanism of void growth in the region of the plastic zone ahead of a crack-tip. K.Jagannadham (Dept. of Engng. Sci. & Mech., Tennessee Technol. Univ., Cookeville, TN, USA).
Int. J. Fract. (Netherlands), vol.22, no.1, p.41-63 (May 1983).
A detailed dislocation model of the mechanism of void growth is illustrated using both the discrete dislocation analysis and the continuous distribution method. The latter is particularly developed to provide the scaling methods, so that the results can be readily obtained for different sizes of the crack and the void as well as for different positions of the void with respect to the crack. Application of these results to void growth in the region of the plastic zone ahead of a crack tip subjected to alternating stresses and creep is also suggested. (37 refs.)

66980 Impurity atoms in germanium as recombination centers for primary radiation defects. B.A.Beloborodko, E.D.Vasil'eva, V.V.Emtsev, T.V.Mashovets, E.A.Tropp (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1317-18 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2041-2 (Nov. 1982). [received: April 1983]
The authors present a general calculation of defect formation kinetics in Ge crystals. They consider the interaction of primary defects and impurity atoms when the atom is a V-I recombination centre. (5 refs.)

66981 Spektroskopische Untersuching des Zustandes von Helium in Blasen in Aluminium und Nickel (Spectroscopic investigation of the state of helium in bubbles in aluminium and nickel). R.Manzke.
Report JUL-1814, Kernforschungsanlage, Julich, Germany (Nov. 1982), 89 pp. In German.
The physical state of helium in small bubbles in aluminium and nickel films (500-1000 Å thick) with average He concentrations between 1 and 30 at.% has been investigated by transmission electron energy-loss spectroscopy (EELS) with 50 and 200 keV electrons using a new UHV-spectrometer, transmission electron microscopy (TEM), and proton enhanced scattering (PES). (85 refs.)

Defects in Fe_7C_3 type carbide formed during the crystallisation of amorphous high carbon alloys and their relation with the amorphous state .... See Entry 66841

Molecular motion, defect structures and phase transitions in oligomer crystals .... See Entry 66900

Study of local variations in spacing and orientation in a Z-cut plate of a synthetic quartz crystal by X-ray topography .... See Entry 66913

A new method to determine structural domains .... See Entry 67190

Incorporation scheme of H reducing defects in a-Si studied by NMR and ESR .... See Entry 68050

Radiation and spectral characteristics of sapphire crystals produced by various methods .... See Entry 68254

Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals .... See Entry 68285

Changes in dislocation and electronic structure during copper consolidation .... See Entry 68474

61.70B Interstitials and vacancies

(exc. colour centres)

66982 Huang-scattering from self interstitials in electron-irradiated Fe-40 at.% Al ordered alloy. J.P.Guillot, J.P.Rivere, M.F.Beaufort-Richard (Lab. de Metall. Phys., CNRS, Poitiers, France).
J. Phys. (France), vol.44, no.5, p.651-8 (May 1983).
A single crystal of Fe-40 at.% Al ordered alloy has been irradiated with 2.5 MeV electrons at liquid hydrogen temperature, and diffuse X-ray scattering (MoKα_1) near Bragg reflections has been studied after annealing the sample up to 300K. The characteristic diffuse scattering from point defects with weak displacement fields (Huang diffusion) has been observed near the (200) Bragg reflection in the directions [011] and [100] and near the (110) reflection in the directions [110] and [110]. This Huang scattering has been attributed to self interstitials since under the same irradiation conditions, electrical resistivity measurements indicate that the long range migration of self interstitials by annihilation at vacancies would occur only for temperatures higher than 300K. The comparison of the experimental results with the different simple interstitial configurations proposed for b.c.c. crystals suggests that the most probable configuration should be the [110] split interstitial with orthorhombic symmetry. (27 refs.)

66983 Self-interstitial atoms, vacancies and their agglomerates in electron-irradiated nickel investigated by diffuse scattering of X-rays. O.Bender, P.Ehrhart (Inst. fur Festkorperforschung KFA, Julich, Julich, Germany).
J. Phys. F (GB), vol.13, no.5, p.911-28 (May 1983).
Frenkel defects of concentrations varying between 200 and 600 PPM were produced in single crystals of Ni by irradiation with 3 MeV electrons at 4.5K. These radiation-induced defects and their reactions during thermal annealing were investigated by measuring the Huang diffuse scattering of X-rays, the change of the lattice parameter and the electrical resistivity. At 6K the authors observed statistically distributed Frenkel pairs. The configuration of the self-insterstitial atoms (SIA) agrees with the (100) split configurations. The relaxation volume of the SIA was determined to be 1.8 (±0.2) atomic volumes and the Frenkel defect resistivity was ρ_F=7.1(±0.8) μΩ cm at.%$^{-1}$. This set of values implies a relaxation volume for the vacancy of −0.22 atomic volumes. The annealing behaviour of Ni is characterised by interstitial motion during stage I and growth of interstitial type clusters during stage II that eventually form dislocation loops on {111} planes. Impurities of Si (undersized) and Al (oversized) in concentrations comparable to the concentration of the Frenkel defects cannot effectively suppress the cluster growth. Vacancy agglomeration has been observed directly after annealing in stage III. The additional diffuse scattering from the vacancy agglomerates can be distinguished from the scattering from interstitial type loops by its different asymmetry relative to the Bragg reflections. There is a simultaneous decrease of ρ_F with the formation of the vacancy agglomerates. All of these reactions are similar to those in Cu although the growth of the interstitial clusters is retarded for Ni. (37 refs.)

66984 A stochastic theory for clustering of quenched-in vacancies. V. Temperature dependence of cluster density. G.Ananthakrishna (Materials Sci. Lab., Reactor Res. Centre, Kalpakkam, India).
Pramana (India), vol.19, no.6, p.633-43 (Dec. 1982). [received: April 1983]
For pt.IV see ibid., vol.12, no.6, p.581-91 (1979). It is known that the density of vacancy loops in quenched aluminium and stacking fault tetrahedra in quenched gold show a saturation for low ageing temperatures. The physical mechanism leading to this effect is not well understood. The author considers a simple model which allows one to obtain the temperature dependence of total density. The analysis shows that the plateau region arises due to the fact that the number of absorption sites of a cluster is larger than the number of emission sites. The temperature dependence of the average number of vacancies in a cluster and the single vacancy concentration in equilibrium with the clusters are discussed. (10 refs.)

66985 Vacancy defects in GaAs:Sn. E.A.Skoryatina, M.N.Kolotov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1341-2 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2076-7 (Nov. 1982). [received: April 1983]
Investigates nonstoichiometry defects introduced by heat treatment. Variation of the arsenic vapor pressure could be used to create a predominance of defects in one of the GaAs sublattices. Heat treatments (annealing) were applied to n-type GaAs crystals grown by the Czochralski method and doped with tin ($n=5\times10^{17}$ cm^{-3}). A study of the photoluminescence spectra of GaAs:Sn indicated that changes occurred only in the surface layer and these were due to the annealing. (6 refs.)

Local structure of δ-FeOOH .... See Entry 66830

Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4 .... See Entry 66974

Point defects and effective activation parameters for motion of dislocations in Ge and Si at low stresses .... See Entry 66991

On the point and line defects which are common to both degraded light emitting diodes and plastically deformed GaAs .... See Entry 67001

Surface restoration of oxygen-implanted silicon .... See Entry 67024

Influence of the orientation of anisotropic impurity-vacancy complexes upon dislocation charging in NaCl crystals .... See Entry 67031

Vacancy-dislocation interaction energies in MgO. A re-analysis .... See Entry 67032

Effect of pulse laser emission on mercuric telluride .... See Entry 67042

Efficiency of formation of paramagnetic defects in silicon by neutron irradiation .... See Entry 67052

The effect of preinjected gas atoms on depth dependent damage in self-ion irradiated nickel .... See Entry 67058

Influence of point defects due to nonstoichiometry on the densities of oxides .... See Entry 67084

Random field of internal stresses from point defects in a crystal .... See Entry 67085

Hydrogen motion in single-crystal palladium hydride as studied ultrasonically .... See Entry 67117

Irradiation-driven phase transformations in alloys .... See Entry 67161

Variants of the same model for solute diffusion by the interstitial dumb-bell in the FCC lattice .... See Entry 67263

Direct analysis of the structure, concentration, and chemical activity of surface atomic vacancies by specialized low-energy ion-scattering spectroscopy: TiC(001) .... See Entry 67321

Electronic structure of the divacancy in silicon .... See Entry 67512

Influence of intrinsic defects on the electrical properties of $A^{I}B^{III}C_2^{VI}$ compounds .... See Entry 67587

Vacancy centers in single crystals in $Bi_{12}RO_{20}$(R=Si, Ti, Ge) .... See Entry 68016

Electronic spin of the Ga vacancy in GaP .... See Entry 68017

Investigation of deviations from stoichiometry in copper selenide by the method of nuclear magnetic resonance .... See Entry 68039

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

Vibrational properties of silicon networks with vacancy, hydrogen, or fluorine .... See Entry 68216

Compensation mechanism in Ni-diffused n-type GaP [optical absorption spectra] .... See Entry 68280

Effects of pre-irradiation and quenching on the low-temperature thermoluminescence of KCl:Sr .... See Entry 68334

Section of the phase diagram of the In_2Te_3-Fe system in the vicinity of In_2Te_3 and thermodynamic investigation of nonionized impurity atoms in crystals with stoichiometric vacancies .... See Entry 68519

61.70D Colour centres

66986 Hole-burning Stark spectroscopy of the 5770 Å colour centre in NaF. R.T.Harley, R.M.Macfarlane (IBM Res. Lab., San Jose, CA, USA).
J. Phys. C (GB), vol.16, no.12, p.L395-9 (30 April 1983).
Laser-induced spectral hole burning in the presence of applied electric and magnetic fields has been used to determine the symmetry and electronic character of the colour centre in X-irradiated NaF whose zero-phonon line is at 5770 Å. The centre is found to have C_s symmetry, perturbed only slightly from trigonal. The authors speculate that it, and other centres in this special region, may arise from F_3^+ centres perturbed by structural or chemical defects. (10 refs.)

66987 The optical absorption of F and F_H centres in cesium halides. C.K.Ong, J.Adetunji (Dept. of Phys., Nat. Univ. of Singapore, Lower Kent Ridge, Singapore).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K19-21 (1 March 1983).
The authors have employed the approximate pseudopotential of Bartram et al. (1968) and four parameter trial wave functions to investigate the optical absorption energy of F_H centres in cesium halides. (6 refs.)

66988 Effect of Z_1 centres on the isothermal stability of colour centres in microcrystalline powder of KCl. R.B.Pode, D.G.Wakde, B.T.Deshmukh (Dept. of Phys., Nagpur Univ., Nagpur, India).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K39-42 (1 March 1983).
The authors report on the role of alkaline earth impurities (Ca^{2+}, Sr^{2+}, Ba^{2+}) in KCl on the stabilisation of the colouration in this crystal. The crystals were crushed to a powder and exposed to γ-ray irradiation. Measurements were made of the thermoluminescence glow curves with the view of obtaining additional information about the interaction between colour centres and dislocations. (7 refs.)

66989 A study of X_3-center formation in KBr crystals by pulsed optical spectroscopy. Yu.M.Annenkov, V.F.Stolyarenko, T.S.Frangul'yan.
Sov. Phys. J. (USA), vol.25, no.8, p.695-8 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.17-21 (Aug. 1982). [received: April 1983]
The authors study the production of X_3^- color centers in KBr crystals by nanosecond pulsed optical spectroscopy, which allows investigation of the primary stages of formation of this defect. To distinguish the formation of X_3^- centers on radiation-induced cation vacancies they use material with a low level of contamination by impurities of other valence. (11 refs.)

Radiation induced sodium metal colloid formation in natural rock salt from different geological localities .... See Entry 65403

Development of colour centre lasers for spectroscopy applications .... See Entry 66285

Reading and writing of photochemical holes using GaAlAs-diode lasers .... See Entry 66323

Influence of lithium and sodium on radiation defect formation in a KDr crystal in the temperature region 4.2-300K .... See Entry 67046

Gamma irradiation induced photochemical reactions in V-doped borate glasses .... See Entry 67047

Decay of electronic excitations at pairs of charged Frenkel defects in KI .... See Entry 67051

Paramagnetic centers in α-$LiIO_3$ single crystals activated with nickel .... See Entry 68020

Optically detected electron-nuclear double resonance in hydrogenated amorphous silicon .... See Entry 68080

Spatial dispersion of dielectric permittivity in the theory of solvated electrons and F centers .... See Entry 68110

Bromine cluster centers in irradiated doped KBr crystals .... See Entry 68275

Spin-polarization and spin-memory effects in the *F*-center absorption and *F*′ conversion of NaI and NaBr crystals .... See Entry 68283

Glow curves of thermally pre-treated NaCl:Ca crystals .... See Entry 68335

Acoustoluminescence spectra of NaCl and KCl crystals .... See Entry 68336

Properties of polycrystalline indium oxide in the air and in vacuum .... See Entry 68568

61.70E Other point defects

Random field of internal stresses from point defects in a crystal .... See Entry 67085

61.70G Dislocations: theory

66990 The elastic field of a Volterra dislocation in a planar phase boundary. R.Bonnet (Inst. Nat. Polytech. de Grenoble, Domaine Univ., Saint Martin d'Heres, France).
Philos. Mag. A (GB), vol.47, no.4, p.529-36 (April 1983).
The displacement field of an infinitesimal phase boundary dislocation (PBD) loop is first determined from results obtained by Rongved (1955) on the elastic effect of a point force in a two-phase medium. The displacement field of any PBD loop can be derived from a line integral obtained by summing all the contributions of a convenient set of infinitesimal rectangular loops. Explicit expressions are given for the displacement fields of a PBD jog, a semi-infinite PBD dipole and a rectangular PBD loop. (7 refs.)

66991 Point defects and effective activation parameters for motion of dislocations in Ge and Si at low stresses. G.A.Malygin (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1561-4 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2757-62 (Sept. 1982). [received: April 1983]
It is shown that, including the kinetics of segregation of point defects on dislocations eliminates, the disagreement between the experimentally obtained activation parameters for motion of dislocations in Ge and Si and their values derived from the model of the displacement of dislocations along a Peierls relief in the presence of weak barriers on dislocations to the displacement of kinks. (22 refs.)

66992 Interaction of dislocations and deformation hardening of the ordered CuAu alloy. K.I.Zlodeeva, L.E.Popov, N.A.En'shina, V.S.Kobytev (Civil-Engng. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.698-702 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.21-6 (Aug. 1982). [received: April 1983]
The critical configurations of combinations of various types of dislocations in ordered alloys with Ll_0 superstructure are analyzed numerically. The characteristics of the dislocation combinations, as well as the partial resistance to motion of dislocations, owing to interaction of dislocations, are calculated for polycrystals and single crystals with different orientations of the ordered alloy CuAu. (22 refs.)

66993 Resistance to expansion of dislocation loop in FCC metal. R.I.Kurinnaya, L.V.Ganzya, L.E.Popov (Civil-Engng. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.710-13 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.35-8 (Aug. 1982). [received: April 1983]
The authors calculate the strength of dislocation compounds in FCC metals for dislocations of different orientation relative to the Burgers vector. A study is made of the dependence of the coefficient α_r, which characterizes the contribution of the reactive component of a dislocation forest to the flow stress, and the probability β_r of formation of dislocation compounds on the angle ψ_{II} of orientation of glissile dislocations. (9 refs.)

Plastic bend in a growing crystal .... See Entry 66905

A mechanism of void growth in the region of the plastic zone ahead of a crack-tip .... See Entry 66979

Modelling intrinsic stresses by setting up Somigliana dislocations .... See Entry 67005

Vacancy-dislocation interaction energies in MgO. A re-analysis .... See Entry 67032

Cracking due to a plate-form inclusion of shear type .... See Entry 67102

Quantum fluctuation of a dislocation in a two-dimensional Wigner crystal .... See Entry 67490

Electrical resistivity of dislocations in metals .... See Entry 67558

One dimensional transport along dislocations .... See Entry 67571

A dislocation model for the aragonite⇄calcite transition .... See Entry 69193

61.70J Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations

66994 Recombination enhanced dislocation glide in InP single crystals. K.Maeda, S.Takeuchi (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Appl. Phys. Lett. (USA), vol.42, no.8, p.664-6 (15 April 1983).
The glide mobility of dislocations in bulk *n*-type InP single crystals was measured by the double-etching method as a function of temperatures with or without 30-keV electron beam irradiation. The mobility of β dislocations was found to be enhanced by the irradiation in such a manner that the mobility increase is caused by a decrease in the apparent activation energy, which is characteristic of recombination enhanced defect reaction phenomena. The enhancement is not much different in its magnitude from the same type of dislocations in GaAs. (16 refs.)

66995 Dislocation etching of tin iodide single crystals. C.C.Desai, J.L.Rai (Dept. of Phys., Sardar Patel Univ., Gujarat, India).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.355-9 (1983).
Single crystals of tin-iodide (SnI_2) have been grown using the controlled reaction between $SnCl_2$ and KI by a diffusion process in a gel medium. As grown (010) surfaces of the crystals have been optically studied. Characteristic etch pits have been observed on them. This suggests that SnI_2 crystals might go into dissolution in the acid-set gel. By successively etching (010) surfaces in a mixture of ammonia, acetic acid, and $CdCl_2$ solution, it is established that the pits indicate the site of dislocations in the crystals. This is further confirmed by comparing the etch patterns before and after chemically polishing (010) surfaces. The average dislocation density in the crystals have been evaluated and found to be 3.2×10^3 cm^{-2} and the implications are discussed. (7 refs.)

66996 On the estimation of X-ray extinction changes due to randomly distributed dislocations in crystals. P.Klimanek, K.-H.Hanisch (Section of Metall. & Materials Technol., Acad. of Mining, Freiberg, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.361-5 (1983).
A procedure proposed by Ivanov, Klimanek and Skakov for the quantitative estimation of X-ray extinction in crystals containing randomly distributed dislocations is established without restriction concerning the defect density on the basis of stochastic geometry. The dependence of the extinction coefficient of a X-ray diffraction peak obtained in this way agrees very well with experimental observations. (23 refs.)

66997 Etch pits on bismuth cleavages in nitric acid-n-butyl alcohol mixtures. L.K.Maniar, B.S.Shah (Dept. of Phys., Saurashtra Univ., Rajkot, India).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.K43-4 (1983).
Bi crystals were cleaved in the conventional manner at liquid nitrogen temperatures. The etchant used was made up of AR grade fuming nitric acid and n-butyl alcohol. The composition of the etchant was one part of fuming nitric acid and five parts of n-butyl alcohol. The bismuth cleavages were etched for various times from minutes to hours. Well defined, hexagonal pits in crystallographic directions were obtained, which were produced at the site of dislocations. (5 refs.)

66998 Determination of the sense of Burgers vector by plane-wave X-ray topography. K.Ishida, Y.Kobayashi, H.Katoh, S.Takagi (Dept. of Phys., Faculty of Sci. & Technol., Science Univ. of Tokyo, Chiba, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L151-3 (March 1983).
Dislocation images of a Si single crystal are observed by three-crystal topography with (+, +, −) setting. The images change with the diffraction condition of the topograph. The image taken out of the exact Bragg condition is sharp and its position is slightly displaced due to the strain induced around the dislocation. The sense of the Burgers vector is determined by the relation between the direction of the displacement and the diffraction condition of the topograph. (7 refs.)

66999 Dislocation etch pits & identification of slip systems in potassium perchlorate crystals. V.P.Bhatt, R.M.Patel, C.F.Desai (Dept. of Phys., Faculty of Sci., MS University of Baroda, Baroda, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.990-1 (Dec. 1982). [received: April 1983]
New chemical etchants capable of revealing dislocations intersecting (001) and (110) planes in $KClO_4$ crystals are reported. In addition to the known cleavage plane (001), another cleavage along (110) is found to exist in this crystal. The slip systems operative in this type of crystals are reported for the first time. (4 refs.)

67000 Resolution of dislocation lines in germanium by etching. E.B.Gorokhov (Inst. of Semiconductor Phys., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.741-3 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.885-7 (June 1982). [received: Feb. 1983]
An etching reagent composition is proposed for resolving dislocation lines on germanium. The referred technique of resolution of the said type of dislocations has certain advantages over such known techniques as X-ray topography or plasma etching because of its simplicity, high efficiency, and high resolving power. Low etching rate makes it possible to investigate dislocation structures in thin surface-adjoining layers of germanium. (5 refs.)

67001 On the point and line defects which are common to both degraded light emitting diodes and plastically deformed GaAs. Z.Liliental (Center for Solid State Sci., Arizona State Univ., Tempe, AZ, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2097-102 (April 1983).
Similar dipoles with Burger's vector $\mathbf{b}=\mathbf{a}/2$ [101] (also referred to as dark line defects) were found in the active layer of degraded light emitting diodes (LEDs) and in plastically deformed GaAs. The dependence of characteristic X-ray production of electron channeling conditions has been used in an electron microscope to study point defects in the neighborhood of these dipoles. The results are consistent with the occurrence of I_{As}, $I_{As}+V_{Ga}$ and I_{GaAs} in descending order of likelihood. Of these, $I_{As}+V_{Ga}$ can explain the dislocation climb without any extra point defects involved in such process. (24 refs.)

67002 In situ X-ray topographic study of the dislocation mobility in high-purity and impurity-doped silicon crystals. M.Imai, K.Sumino (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Philos. Mag. A (GB), vol.47, no.4, p.599-621 (April 1983).
An in situ X-ray topographic technique using a high-power X-ray generator has been used to study the dislocation mobility at elevated temperatures in the stress range 1.2-40 MN m^{-2} for pure and impurity-doped silicon crystals. The variation of velocity with stress for both 60° and screw dislocations in high-purity crystal is linear throughout the whole stress range investigated, the activation energies for motion being independent of stress. No previously published theoretical models are able to account for the measured velocities quantitatively. Effects of impurities, such as oxygen, carbon, nitrogen, phosphorus and boron, are investigated in detail. Generally, the impurities bring about a deviation from linearity of the variation of velocity with stress under low stresses. Dislocations originally moving in impure crystals are immobilized when the stress becomes lower than a critical value. These phenomena are interpreted in terms of the development of an impurity atmosphere around slowly moving dislocations. Phosphorus atoms are known to enhance the dislocation motion under high stresses and to retard it under low stresses. (40 refs.)

67003 Influence of the medium on the distribution of dislocations near a surface parallel to the Burgers vector in deformed LiF crystals. O.A.Klyavin, G.I.Shvets (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1526-8 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2692-6 (Sept. 1982). [received: April 1983]
The density of dislocations in screw slip bands was shown to decrease near the outer surface parallel to the Burgers vector in LiF crystals deformed in vacuum at 4.2K. Decrease in dislocation density extends to a distance up to 25 μ. No such decrease occurs near the aforementioned surface when the crystal is deformed in a medium of liquid helium. The results obtained are discussed in terms of dislocation-dynamic diffusion, i.e. penetration of impurity atoms of the ambient medium into the crystal lattice along moving dislocations. (15 refs.)

Transmission electron microscopic study of experimentally deformed K-feldspar single crystals. The (010)[001], (001)$^1/_2$[$\bar{1}$10], (110)$^1/_2$[$\bar{1}$12] and (1$\bar{1}$1)$^1/_2$[110] slip systems .... See Entry 67006

Electron microscopy of antiphase domain boundary tubes in deformed ordered alloys .... See Entry 67007

Structural width of low-angle grain boundaries in olivine .... See Entry 67008

Segregation of solute atoms at dislocations in low-angle grain boundaries .... See Entry 67009

Analysis of high-voltage, high-resolution images of lattice defects in experimentally-deformed dolomite .... See Entry 67012

Inner differentiation of growth sectors induced by the interaction between dislocations and sector boundaries in KH_2PO_4 crystals .... See Entry 67030

Copper precipitation in long-time diffused silicon .... See Entry 67212

The surface energy of zinc .... See Entry 67339

Resistivity, Hall mobility and leakage current variations in undoped semi-insulating GaAs crystal grown by LEC method .... See Entry 67590

Domains in crystals of the barium-strontium niobate type .... See Entry 68137

Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state .... See Entry 68526

An X-ray diffraction study of lattice imperfection in cold-worked FCC alloys. IV. Copper-germanium (alpha-phase) .... See Entry 68560

Alterations in the microstructure of 304 stainless steel produced by small strain deformation at ambient temperature .... See Entry 68588

Temperature dependence of $\{11\bar{2}2\}\langle\bar{1}\bar{1}23\rangle$ slip in zinc .... See Entry 68597

Substructure and back stress changes resulting from the cyclic loading of $2^1/_4$Cr-1Mo steel at 755K .... See Entry 68601

Bauschinger effect in a dual-phase steel .... See Entry 68605

61.70L Slip, creep, internal friction and other indirect evidence of dislocations

(see also 62.20H Creep, 62.40 Internal friction)

67004 The influence of internal stress fields on the velocity of dislocations in BCC crystals. M.Anglada (Dept. de Ciencia de los Materiales, Univ. Simon Bolivar, Caracas, Venezuela).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.239-44 (April 1983).
The dislocation dynamics in the presence of a periodic internal stress field $\tau_i(x)$ was analysed in b.c.c. crystals by using the velocity-stress relationship which results from the nucleation of kink pairs on the screw dislocation at temperatures near the 'knee' temperature. It is shown that, for stresses much greater than the amplitude τ_0 of $\tau_i(x)$, the effective internal stress τ_μ is a constant equal to τ_0. For stresses close to τ_0, the effective internal stress depends on the applied stress. the implications of this with respect to the determination of the activation parameters for thermally activated dislocation glide are discussed and it is shown that, although the change in τ_μ has a very small effect on the determination of the activation energy for the short-range mechanism, the apparent activation area measured from experiments can be substantially greater than the true activation area. (17 refs.)

67005 Modelling intrinsic stresses by setting up Somigliana dislocations. M.N.Dveres, A.V.Fomin.
Mech. Solids (USA), vol.17, no.3, p.152-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Mekh. Tverd. Tela*, vol.17, no.3, p.165-7 (1982).
Demonstrates that there is an analogy between problems of incompatible initial deformations and Somigliana dislocations. Intrinsic stresses are modelled by setting up Somigliana dislocations—slits, deformations, and splices. Deformation is performed on the basis of a particular solution of the corresponding problem of elasticity. It is shown that the method is applicable in cases in which the incompatibility tensor or dislocation-density tensor is known instead of the initial deformations. Unlike the method of elimination of deformations the method can be realized with models of incompressible material. (8 refs.)

67006 Transmission electron microscopic study of experimentally deformed K-feldspar single crystals. The (010)[001], (001)$^1/_2$[$\bar{1}$10], (110)$^1/_2$[$\bar{1}$12] and (1$\bar{1}$1)$^1/_2$[110] slip systems. E.Scandale, M.Gandais, C.Willaime (Lab. de Mineralogie Cristallographie, Univ. Pierre et Marie Curie, Paris, France).
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.182-7 (1983).
A set of sanidine single crystals were previously deformed at 700°C in a Griggs triaxial press with different crystallographic orientations of the core so as to induce dislocation glide of different slip systems respectively. Deformed crystals have been studied by transmission electron microscopy (TEM) and the activated slip systems have been characterized for two orientations. The (010)[001] and (001)$^1/_2$[$\bar{1}$10] systems expected for one orientation (main stress nearly parallel to [012]) are observed, whereas the (001)[100] system expected for the other orientation (main stress nearly parallel to [101]) is never observed. In the latter specimen the deformation is rather difficult and occurs through unexpected systems characterized as (110)$^1/_2$[$\bar{1}$12] and (1$\bar{1}$1)$^1/_2$[110]. In all the samples studied the deformation is heterogeneous, exhibiting dislocation configurations related to temperature variations. (5 refs.)

Self-interstitial atoms, vacancies and their agglomerates in electron-irradiated nickel investigated by diffuse scattering of X-rays .... See Entry 66983

Effect of Z_1 centres on the isothermal stability of colour centres in microcrystalline powder of KCl .... See Entry 66988

Dislocation etch pits & identification of slip systems in potassium perchlorate crystals .... See Entry 66999

Influence of the medium on the distribution of dislocations near a surface parallel to the Burgers vector in deformed LiF crystals .... See Entry 67003

Analysis of high-voltage, high-resolution images of lattice defects in experimentally-deformed dolomite .... See Entry 67012

Influence of the orientation of anisotropic impurity-vacancy complexes upon dislocation charging in NaCl crystals .... See Entry 67031

Yield point and dislocation mobility in silicon and germanium .... See Entry 67096

Kinetics of strain-induced reorientation of zinc-sulfide and zinc-selenide crystal structures .... See Entry 67097

Peculiarities of the plastic deformation of crystals with a curved lattice .... See Entry 67098

Structure of electrolytic cobalt-nickel alloy deposits .... See Entry 67409

Influence of the normal phase concentration and morphology on the superconductor flow stress .... See Entry 67844

Influence of repeated heat treatment on critical current density of Nb-50 wt.% Ti alloy superconductors .... See Entry 67871

Investigation of dislocations in silicon by the ESR method .... See Entry 68019

Luminescence of semiconductors containing charged dislocations .... See Entry 68326

The work-hardening behaviour of hydrogen-charged high purity iron single crystals at temperatures between 296 and 200K .... See Entry 68562

Temperature dependence of $\{11\bar{2}2\}\langle\bar{1}\bar{1}23\rangle$ slip in zinc .... See Entry 68597

Deformation in 30% cold-rolled Cu-30Zn brass grains .... See Entry 68598

Tensile creep and relaxation of the lamellar Al-Al_2Cu composite. Experiments on the tensile stage of a high voltage transmission electron microscope (HV TEM) .... See Entry 68612

61.70N Grain and twin boundaries

67007 Electron microscopy of antiphase domain boundary tubes in deformed ordered alloys. C.T.Chou, S.P.Hirsch (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.91-104 (8 May 1983).
Antiphase domain boundary (APB) tubes have been observed in a slightly deformed Fe-30.5 at.% Al alloy in dark field electron microscope images taken in superlattice reflexions. The image contrast theory has been developed and accounts satisfactorily for the nature of the APB tube contrast observed. The contrast theory is used to estimate the heights of the tubes. The widths of the tubes range from 20 to 50 Å, and the measured heights are in the range of one to six times the elementary height. Evidence is presented that tubes are generated by the Vidoz and Brown (1962) mechanism and by a mechanism of cross-slip and annihilation of screw superdislocations. The possible effects of tubes on flow stresses are discussed. (20 refs.)

67008 Structural width of low-angle grain boundaries in olivine. D.L.Ricoult, D.L.Kohlstedt (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.133-8 (1983).
Electron diffraction and imaging techniques have been used to examine the structure and thickness of low-angle grain boundaries in olivine. For edge-on grain boundaries, a periodic array of dislocations in a boundary gives rise to sets of periodic rods of diffracted intensity that are recorded as streaks in the diffraction pattern. The length of these streaks provides a measure of the structural width of a boundary. For olivine, the structural width of a boundary with a given dislocation spacing is three to four times smaller than that in metals where the boundary width is approximately equal to the spacing between dislocations in the boundary. (24 refs.)

67009 Segregation of solute atoms at dislocations in low-angle grain boundaries. A.Greenberg, Y.Komem (Dept. of Materials Engng., Technion-Israel Inst. of Technol., Haifa, Israel), C.L.Bauer.
Scr. Metall. (USA), vol.17, no.3, p.405-10 (March 1983).
Bicrystalline thin films of gold, containing 4 and 16° [001] tilt boundaries, have been implanted at room temperature with cobalt, chromium, lead and gold at an energy of 40 keV and integrated fluxes ranging from 1 to 100×10^{13} ion/cm^2 and subsequently examined by transmission electron microscopy. It was observed that the discrete strain-contrast pattern associated with individual dislocations in low-angle boundaries is obliterated by implantation with cobalt or chromium, but not by implantation with lead or self-implantation with gold at integrated fluxes ranging from 1 to 10×10^{13} ion/cm^2. It is concluded that cobalt and chromium segregate at grain boundaries, thereby distorting the lattice and obliterating the discrete strain-contrast pattern, whereas lead, being totally immiscible in gold, segregation at free surfaces. This interpretation is consistent with a model wherein the width of dislocation cores is dependent on the gradient of grain boundary energy as a function of misorientation angle. These results suggest that segregation of impurities at low-angle grain boundaries alters grain boundary structure in much the same manner that adsorption of impurities alters surface structure. (10 refs.)

67010 A new structural representation of symmetric tilt boundaries in the [001] direction in FCC lattices. E.A.Bukin, A.N.Orlov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1321-3 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2146-9 (Nov. 1982). [received: May 1983]
Ashby et al. (1978), Smith et al. (1977) and Frost et al. (1980) used graphic methods and computer simulation to determine the atomic structure of a number of symmetric special tilt boundaries relative to the ⟨001⟩ axis in FFC crystals. It was shown that these boundaries are made up of (somewhat distorted) Bernal polyhedra—extended triangular prisms and pentagonal bipyramids. These polyhedra form chains parallel to the axis of revolution in which the extended triangular prisms abut at their end faces and the pentagonal bipyramids are arranged vertex-to-vertex. In an ordinary boundary with misorientation angle θ lying between the two 'special' values ${\theta_i}^0$ and ${\theta_{i+1}}^0$ the stuctural elements of the boundary characterized by the angles ${\theta_i}^0$ and ${\theta_{i+1}}^0$ are present in different proportions. The present authors demonstrate that these structural elements can be regarded as combinations of very simple polyhedra, viz. distorted tetrahedra (T) and octahedra (O) (this is called the OT-representation). Undistorted tetrahedra and octahedra are the structural elements in perfect FCC and close-packed cubic lattices. The authors also show that the arrangement of atoms in one of the planes perpendicular to the rotation axis can be used to deduce the atomic structure of the entire bicrystal. (5 refs.)

67011 Comparison between natural and synthetic grain boundaries by means of discontinuous precipitation. W.Gust, S.Stiltz, B.Predel (Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Z. Metallkd. (Germany), vol.74, no.4, p.206-11 (April 1983). In German.
The growth kinetics of the discontinuous precipitation have been investigated in tetracrystals of the Cu-4 at.% Ag alloy. The tetracrystals possess, at the same time, two natural random grain boundaries as well as a synthetic one with the same geometry. The tetracrystals permitted a direct comparison of both types of grain boundaries under otherwise identical conditions. The measurements of the growth velocity and of the particle spacing have been carried out separately for the individual grain boundaries. The comparison of the experimentally determined grain boundary diffusivities and the findings which are present in the literature, are indicating the same behaviour and, herewith, the same structure of natural as well as of synthetic grain boundaries. (17 refs.)

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep .... See Entry 67100

A neutron scattering study on the incommensurate-commensurate $\varepsilon\rightarrow\zeta$ phase transiton of the perovskite-type layer compound PAMC: A lock-in phase transition with a flipping modulation vector .... See Entry 67198

The AC conductivity of polycrystalline LISICON, $Li_{2+2x}Zn_{1-x}GeO_4$, and a model for intergranular constriction resistances .... See Entry 67270

Diffusion induced grain boundary migration and recrystallization in the Cu-Ni system .... See Entry 67292

Structure of electrolytic cobalt-nickel alloy deposits .... See Entry 67409

Diffusion of arsenic and phosphorus in laser-processed-polycrystalline-silicon-thin-films .... See Entry 67413

Grain boundaries in crystallized silicon thin films .... See Entry 67619

Grain boundaries and intragrain defects dependence of local and global electronic and photovoltaic properties of CGE polysilicon .... See Entry 67699

Potential applications of poly-silicon as an electronic-device material .... See Entry 67775

Theory of MOSFET operation in small-grain polysilicon .... See Entry 67803

Physical and electrical properties of polycrystalline silicon thin films .... See Entry 67825

Ferroelectric phase transitions in $CsLiWO_4$ .... See Entry 68135

Ferroelectric domains of a new type: closed loop domains at twinning boundaries .... See Entry 68138

Sintering behaviour of an yttria stabilized zirconia .... See Entry 68485

Microstructural features of charge density wave (CDW) and martensitic transformations in TiNiFe and TiNiAl alloys .... See Entry 68542

Kinetics of grain growth .... See Entry 68556

Effect of electric current pulses on the recrystallization of copper .... See Entry 68564

Alterations in the microstructure of 304 stainless steel produced by small strain deformation at ambient temperature .... See Entry 68588

Superplasticity: a review of data .... See Entry 68589

Deformation in 30% cold-rolled Cu-30Zn brass grains .... See Entry 68598

The influence of trace additions of zirconium on diffusional creep in Ni-20% Cr .... See Entry 68604

Observations of cyclic grain boundaries migration in aluminium after large numbers of fatigue cycles .... See Entry 68614

Intergranular fracture of high purity iron due to oxygen .... See Entry 68626

Brittleness of Sendust .... See Entry 68627

Fracture surfaces and mechanical properties of tungsten heavy metals .... See Entry 68645

Precipitation induced embrittlement after thermal exposure of high-manganese, austenitic retaining-ring steels .... See Entry 68648

Influence of the breakdown mechanism on the behavior of lead-antimony alloys with an alternating load .... See Entry 68651

Comments on: deformation twins in punched specimens of a 321 steel .... See Entry 68739

Deformation in punched specimens of type 304 stainless steel .... See Entry 68740

Study of the grain boundary effects in N-P junction polycrystalline Si solar cells .... See Entry 68888

Passive and enhanced grain boundaries in solar cells by gas immersion laser diffusion .... See Entry 68893

61.70P Stacking faults, stacking fault tetrahedra and other planar or extended defects

67012 Analysis of high-voltage, high-resolution images of lattice defects in experimentally-deformed dolomite. D.J.Barber (Phys. Dept., Univ. of Essex, Colchester, England), L.A.Freeman, D.J.Smith.
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.102-8 (1983).
Deformation-induced stacking defects in dolomite have been characterised following examination at the cation sublattice level using high-resolution electron microscopy at 500 kV. Slip on c ($\equiv\{0001\}$) is observed to produce stacking faults, often delocalised laterally, which are terminated by partial dislocations with Burgers vectors of the form 1/3 $[1\bar{1}00]$; a model for the faulted dolomite lattice has been constructed which agrees with the image appearance. Slip on f ($\equiv\{10\bar{1}2\}$) produces long planar faults which are established as not being stacking faults, in the normal sense, since there appear to be no offsets of the cation sublattice across the faults, nor any general indication of any terminating partial dislocations; it is proposed that the contrast arises from rotational disorder in CO_3 groups which has resulted from the prior passage of partial dislocations during deformation. (20 refs.)

A stochastic theory for clustering of quenched-in vacancies. V. Temperature dependence of cluster density .... See Entry 66984

Estimation of stacking-fault energy of Frank loops in OKh16N15M3B austenitic stainless steel .... See Entry 67067

Copper precipitation in long-time diffused silicon .... See Entry 67212

Structure of electrolytic cobalt-nickel alloy deposits .... See Entry 67409

Electronic and ionic polarizabilities in some rutile type crystals ....See Entry 68152

An X-ray diffraction study of lattice imperfection in cold-worked FCC alloys. IV. Copper-germanium (alpha-phase) ....See Entry 68560

61.70R Crystal impurities: general

(see also 71.55 Impurity and defect levels; 81.10 Purification techniques)

67013 A correlation between tetrahedral radius and solid solubility of group III, IV and V impurities in germanium. P.Cappelletti, G.F.Cerofolini, G.U.Pignatel.
Philos. Mag. A (GB), vol.47, no.4, p.623-6 (April 1983).
In strict analogy with that found for silicon, a correlation between the tetrahedral radius and the strain entropy of groups IIIA, IVA and VA substitutional impurities has been found in germanium. (2 refs.)

The influence of Bi on the lattice constant and the carrier concentration of PbTe ....See Entry 66942

61.70T Doping and implantation of impurities

67014 Characterization of disordered bonds in Si-implanted $Ga_{0.47}In_{0.53}As$ with laser Raman spectroscopy. K.Kakimoto, T.Katoda (Inst. of Interdisciplinary Res., Univ. of Tokyo, Tokyo, Japan).
Appl. Phys. Lett. (USA), vol.42, no.9, p.811-13 (1 May 1983).
Difference in degree of disorder introduced by ion implantation into In-As and Ga-As bonds in $Ga_{0.47}In_{0.53}As$ was studied with laser Raman spectroscopy. The disorder is introduced more easily into the In-As bond than into the Ga-As one. The disorder is removed simultaneously from both bonds with annealing at a temperature higher than 600°C. (11 refs.)

67015 Summary of the Fourth International Conference on ion implantation: equipment and techniques. H.Glawischnig (Siemens AG, Munich, Germany), H.Ryssel, C.McKenna.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1693-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
On September 13-17, 1982, the Fourth International Conference on Ion Implantation: Equipment and Techniques, was held in Berchtesgaden, Germany. Seventy-seven invited and contributed papers in the fields of ion-implantation equipment (ion sources, high-current implanters for metals and semiconductors, beam scanners, wafer cooling, wafer transport, etc.), equipment testing (dosimetry, voltage calibration, etc.), special measuring techniques for implanted layers, as well as applications of ion implantation to semiconductors and metals, were presented. In addition, a school on problems concerning the use of ion implantation was held. This paper summarizes the various presentations. (2 refs.)

67016 MeV ion implantation systems for production processing of silicon wafers. G.A.Norton, G.M.Klody (Nat. Electrostatics Corp., Middleton, WI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1701-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A 3 MeV boron implantation system is presently undergoing final beam tests prior to shipment. This is a 1.2 MV tandem Pellertron based system capable of automatically processing 20 wafers per hour at a dose of 10^{13} ions/cm^2 for 100 mm wafers using a serial, cassette to cassette, wafer handler. This system is equipped with a reliable negative ion cesium sputter source and electrostatic beam, scanning after 90° magnetic energy analysis. With the exception of the wafer handler and some vacuum valves, the entire vacuum system including the ion beam accelerating tube is all metal and ceramic. The vacuum system is automated. A microprocessor provides for data logging into a customer supplied computer. A single ended 3 MV Pelletron based implanter has also been designed for high dose, rapid throughput implantation of 3 MeV singly charged ions. Both systems, accomodate 100 mm and 125 mm diameter wafers. Both systems are designed for high reliability, minimum down time and simple maintenance. (2 refs.)

67017 Progress in ion beam mixing. S.Matteson (Central Res. Labs., Texas Instruments Inc., Dallas, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1705-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Ion Beam Mixing is a rapidly progressing scientific field marrying material science and ion physics. Technological applications are presently under exploration even though the phenomenological processes are not fully understood. The present work examines the experimental data which provide an understanding of the underlying processes occuring during ion beam mixing. Experimental results of ion beam mixing of thin evaporated Sn layers in mixed Ge/Si solid solutions are reported. Tentative conclusions are drawn as to the likely directions for fruitful avenues of investigation. (16 refs.)

67018 Ion implantation into GaAs for microwave device applications. W.M.Paulson (Semiconductor Res. & Dev. Lab., Motorola Semiconductor Product Sector, Phoenix, AZ, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1713-17 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The direct implantation of dopants into semi-insulating GaAs materials provides the active layers for microwave transistors and high speed ICs. Background impurities and stoichiometric defects in the starting material influence the properties of the active layers. Silicon implants produce n-type layers with mobilities of 4600 cm^2/V-s and Be implants yield p-type layers with bulk mobilities. Higher dose silicon implants give reproducible contact resistivities below 10^{-6} ohm-cm^2. Oxygen implantation ensures device isolation and minimizes backgating effects on ICs. High frequency MESFETs and ICs have been fabricated utilizing the versatility of ion implantation. (34 refs.)

67019 Effects of low temperature annealing of $B^+ + Si^+$ or $BF_2{}^+ + Si^+$ implanted silicon. S.R.Wilson, R.B.Gregory, W.M.Paulson (Semiconductor Res. & Dev. Lab., Inc., Phoenix, AZ, USA), A.H.Hamdi, F.D.McDaniel.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1730-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Silicon wafers have been implanted with B^+ or $BF_2{}^+$ at two different energies. Some of the wafers were subsequently implanted with Si at room temperature or at LN_2 temperature to enhance the lattice damage. The wafers were annealed at temperatures ranging from 600°C to 900°C. The effects of the different implant energies and of the resulting lattice damage, dopant profiles and electrical properties are discussed. (6 refs.)

67020 Characterization of ion implanted silicon annealed with a graphite radiation source. S.R.Wilson, R.B.Gregory, W.M.Paulson, H.T.Diehl (Semiconductor Res. & Dev. Lab., Motorola Inc., Phoenix, AZ, USA), A.H.Hamdi, F.D.McDaniel.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1734-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A Varian IA-200 isothermal annealer has been used to anneal ion implantation damage and electrically activate dopants in As and B implanted silicon with minimal redistribution of the impurity. The anneal occurs in vacuum using infrared radiation from a resistively heated sheet of graphite. Good quality anneals of ^{11}B implanted samples have been obtained with minimal boron diffusion. Arsenic implanted wafers have also been annealed with excellent results except for a substantial loss of As which occurs unless the wafer has an SiO_2 cap. The anneal quality of (100) wafers was independent of dose, however, the anneal quality of the (111) wafers improved with increasing As dose. (22 refs.)

67021 In situ study of implantation-induced silicon amorphisation. M.O.Ruault, J.Chaumont, H.Bernas (Lab. Rene Bernas, CSNSM, Orsay, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1746-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The formation and evolution of radiation damage due to room temperature and 100K Bi ion implantation in Si at 50 keV and 200 keV was studied during implantation and annealing via in situ transmission electron microscopy (TEM) using the newly developed facility at Orsay. (15 refs.)

67022 Mass transfer of iron during doping of epitaxial layers of gallium arsenide. N.A.Chernov, N.N.Bakun, I.Sh.Akhunov, G.M.Ikonnikova.
Inorg. Mater. (USA), vol.18, no.5, p.730-2 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.870-1 (May 1982). [received: Feb. 1983]
One method for obtaining semiinsulating epitaxial layers of GaAs in gas-phase epitaxy is doping of a growing layer with iron, which forms deep acceptor levels in the forbidden zone of gallium arsenide. The authors investigated the transfer of iron by means of an H_2+HCl stream as a function of the flow rate and the temperature of the source. The investigations were carried out with an industrial apparatus designed for the preparation of epitaxial layers of GaAs by the chloride method. The studies of iron transfer made it possible to find the conditions for the introduction of iron into the gas phase and to obtain high-resistance epitaxial layers of gallium arsenide with a specific resistance of 10^5 to 10^7 Ω.m at a fine donor impurity concentration of $(2\text{-}3)\times10^{22}$ m^{-3}. (8 refs.)

67023 Study of ion-implanted damage in GaAs:Be and inP:Be using Raman scattering. C.S.Rama Rao, S.Sundaram (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA), R.L.Schmidt, J.Comas.
J. Appl. Phys. (USA), vol.54, no.4, p.1808-15 (April 1983).
The Raman spectra of GaAs and InP implanted with Be ions with fluences ranging from 5×10^{12} to 1×10^{16} cm^{-2} were investigated. A marked difference in the behaviour of the TO and LO modes with respect to broadening with fluence was observed and the results indicate that this is caused by frequency dependent anharmonic damping constants. The Raman spectra of high fluence samples were interpreted in terms of disorder-induced first-order Raman spectra due to phonons with nonzero wave vectors. The similarities between the authors' 'Reduced Raman Spectra' of the disordered form and a theoretical one-phonon density of states, are presented without introducing Gaussian broadening as suggested by earlier authors studying amorphous materials. The observations support the conclusion that the form essentially retains the short-range order of the crystalline phase; the phonon spectrum of the crystal is largely determined only by near-neighbor interactions; and the existence of a frequency-dependent coupling constant for the scattering intensity at least in the low frequency region. (39 refs.)

67024 Surface restoration of oxygen-implanted silicon. M.J.Kim, D.M.Brown, M.Garfinkel (Corporate Res. & Dev., General Electric Co., Schenectady, NY, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1991-9 (April 1983).
The effects of oxygen implantation and annealing conditions on surface crystal restoration were studied as a function of temperature, by means of infrared spectroscopy, ultraviolet reflectance, electron microscopy, and secondary ion mass spectroscopy analysis. The oxygen interstitial absorption band shifts from 1020 to 1100 cm^{-1} with annealing temperature, and the structure of the buried oxide changes with annealing condition. The restoration process is enhanced by defects formed during implantation. The binding energy of the oxygen-vacancy complex was found to be (0.48 ± 0.03) eV from kinetic analysis. Low-temperature implantation combined with a long-term single-stage annealing is found to be suitable for good surface restoration. (31 refs.)

67025 Effect of phosphorus doping on stress in silicon and polycrystalline silicon. S.P.Murarka, T.F.Retajczyk,Jr. (Bell Labs., Murray Hill, NJ, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2069-72 (April 1983).
An investigation of the polysilicon stress properties as a function of film thicknesses and phosphorus doping showed that as-deposited films are moderately compressive, and become less compressive with increasing film thickness. High temperature PBr_3 diffusion in silicon produces wafer bending corresponding to a tensile stress in wafer. Following a PBr_3 diffusion, polysilicon films, however, become less compressive. Subsequent oxidation introduces an additional compressive stress component in the order of $2\text{-}3\times10^9$ dyne/cm^2 for oxidation temperatures between ~900-1000°C. The thermal expansion coefficients were similar for doped and undoped films ($\alpha\sim2.9$ ppm/°C) and slightly less than for ⟨100⟩ silicon, while the doped films were found to be less stiff than undoped ones but both were less stiff than ⟨100⟩ silicon. The observed changes in polysilicon stress due to film thickness and phosphorus doping have been interpreted in terms of a grain growth model wherein those factors which lead to enhanced grain growth also result in reduced compressive stresses. (19 refs.)

67026 Effective *p*-type doping of diamond by boron ion implantation. G.Braunstein, R.Kalish (Phys. Dept., Technion-Israel Inst. of Technol., Haifa, Israel).
J. Appl. Phys. (USA), vol.54, no.4, p.2106-8 (April 1983).
Highly conducting *p*-type diamond layers have been obtained by high-dose boron implantation followed by annealing (1400°C) and subsequent removal of the graphite-like layer that is formed as a result of the heat treatment. Conductivity and Hall measurements showed transport features typical of heavily doped semiconductors. The fact that identical carbon implantations have yielded no measurable conductivity is taken as evidence that the highly conductive *p*-type layer obtained by boron implantation is indeed due to effective doping. (15 refs.)

67027 The different roles of nitrogen in RF-sputtered and RF glow discharge hydrogenated amorphous silicon. G.J.Smith, W.I.Milne (Engng. Dept., Univ. of Cambridge, Cambridge, England).
Philos. Mag. B (GB), vol.47, no.4, p.419-29 (April 1983).
The effect of nitrogen in hydrogenated amorphous silicon (a-Si:H) has been investigated using thin films produced by RF-sputtering and by RF glow discharge decomposition of silane. In RF-sputtered a-Si:H a donor action is observed and E_F may be moved to within 0.2 eV of E_c. In contrast, a large nitrogen content in glow discharge a-Si:H gives conductivity enhancement, but no doping effect. These results are discussed and compared with those from a-Si:H doped using other techniques. (20 refs.)

Factors influencing the design of implanters for metal applications .... See Entry 65712

Doping of amorphous silicon by implantation of manganese ions .... See Entry 66849

Ag photodoping of amorphous chalcogenides .... See Entry 66850

Analysis of thermal stresses induced in silicon during xenon arc lamp flash annealing .... See Entry 67035

Damage analysis and atom site determination in ion-implanted GaAs using low energy proton channeling and PIXE .... See Entry 67057

The analysis of Rutherford scattering-channelling measurements of disorder production and annealing in ion irradiated semiconductors .... See Entry 67061

Channeling contrast microscopy: Application to semiconductor structures .... See Entry 67069

Channeling effect of low energy boron implant in (100) silicon .... See Entry 67075

Incidence angle dependence of planar channeling in boron ion implantation into silicon .... See Entry 67076

Solid solubility and precipitation of phosphorus and arsenic in silicon solar cells front layer .... See Entry 67226

Boron diffusion during electron pulse annealing of silicon .... See Entry 67287

Doping mechanism and properties of Zn-doped GaN-epitaxial layers .... See Entry 67381

The top silicon layer of SOI formed by oxygen ion implantation .... See Entry 67386

VLSI materials: a comparison between buried oxide SOI and SOS .... See Entry 67387

Lattice parameter changes in $Al_{0.39}Ga_{0.61}As$ due to O, Ge, Si, and S doping .... See Entry 67398

Effects of ion implantation on the thermal growth of Pt and NiPt silicides .... See Entry 67400

Electrical properties of ion-implanted poly(*p*-phenylene sulfide) .... See Entry 67597

Saturation of Si activation at high doping levels in GaAs .... See Entry 67651

Evaluation and control of resistivity in N^-/N^+ epitaxial depositions .... See Entry 67814

Dependences of ESR and electrical properties on P doping ratio for microcrystalline Si .... See Entry 67816

Investigation of the properties of superconducting niobium nitride films .... See Entry 67831

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment .... See Entry 68033

Impurity effect on the Raman spectra of $Sr_{0.6}Ba_{0.4}Nb_2O_6$ .... See Entry 68201

Cathodoluminescence of natural diamond associated with implanted impurities .... See Entry 68333

Secondary ion yield variations due to cesium implantation in silicon .... See Entry 68392

Photoemission studies of reactive diffusion and localized doping at II-VI compound semiconductor-metal interfaces .... See Entry 68404

Dislocation-free GaAs and InP crystals by isoelectronic doping .... See Entry 68429

Deposition and properties of zinc phosphide films .... See Entry 68454

Thermal effect of nitrogen implantation on high carbon steels .... See Entry 68549

Effect of ion implantation on creep of molybdenum .... See Entry 68595

Laser processing of thin surface layers in semiconductors .... See Entry 68676

Modification of the corrosion behavior of engineering alloys by ion implantation .... See Entry 68690

Gas immersion laser diffusion: a new method for making efficient Si solar cells .... See Entry 68887

61.70W Impurity concentration, distribution, and gradients

(see also 66.30J Diffusion, migration and displacement of impurities)

67028 Distribution of indium ions in indium substituted Mn-Zn ferrites. K.H.Rao (Phys. Dept., Andhra Univ., Waltair, India), R.G.Mendiratta.
J. Appl. Phys. (USA), vol.54, no.4, p.1795-9 (April 1983).
The variations in DC resistivity and Mossbauer line intensities for various dopant concentrations of indium in a manganese-zinc ferrite have been investigated to analyze the site occupancy of indium ions. The indium ions are observed to occupy both tetrahedral and octadral sites through the whole range of concentration studied. The picture proposed on the basis of resistivity measurements has been confirmed by Mossauer data. (12 refs.)

67029 Near-neighbor configuration and impurity-cluster size distribution in a Poisson ensemble of monovalent impurity atoms in semiconductors. U.F.Edgal, J.D.Wiley (Dept. of Electrical & Computer Engng., Univ. of Wisconsin, Madison, WI, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4997-5006 (15 April 1983).
The authors present some microscopic (atomic scale) structure analysis for Poisson-distributed impurities in semiconductors. Relevant concepts and results, well established in the area of a geometrical probability, are employed in the analysis. Monte Carlo results for the distribution of 'impurity-cluster' sizes in semiconductor media approximated by their continuum representation are also presented. A closed-form expression for the 'impurity-doublet' probability and a general formulation for the impurity-cluster size distribution are also provided. (22 refs.)

A comparative study of the dopant profiles in diffused planar optical waveguides by SIMS and guided wave probe .... See Entry 66382

Investigation of the structure of solid solutions of elements of the IV. Group (Si, Ge) in gallium antimonide .... See Entry 66940

Spektroskopische Untersuching des Zustandes von Helium in Blasen in Aluminium und Nickel (Spectroscopic investigation of the state of helium in bubbles in aluminium and nickel) .... See Entry 66981

Lateral dopant transport during laser recrystallization of polysilicon .... See Entry 67041

Influence of the degree of doping of a semiconductor on the redistribution of boron in silicon as a result of high-temperature proton irradiation .... See Entry 67063

Trapping of impurity atoms by defects and the distribution of clusters during ion bombardment of growing films .... See Entry 67065

Segregation of In and Te in CdSb .... See Entry 67218

Solid solubility and precipitation of phosphorus and arsenic in silicon solar cells front layer .... See Entry 67226

Verification of the model for phosphorus diffusion from oxide sources into silicon .... See Entry 67285

As migration during PtSi formation .... See Entry 67286

The influence of an external electric field on the silicon homoepitaxy process .... See Entry 67385

Effects of MBE growth conditions on carbon contamination in GaAs .... See Entry 67406

Pulsed electron beam annealing of ion implanted germanium for photovoltaic devices .... See Entry 67774

Investigation of deviations from stoichiometry in copper selenide by the method of nuclear magnetic resonance .... See Entry 68039

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

Compensation mechanism in Ni-diffused n-type GaP [optical absorption spectra] .... See Entry 68280

On iodine behaviour in bulk crystals of PbTe and SnTe synthesized by the iodide method .... See Entry 68420

Section of the phase diagram of the In_2Te_3-Fe system in the vicinity of In_2Te_3 and thermodynamic investigation of nonionized impurity atoms in crystals with stoichiometric vacancies .... See Entry 68519

Structure of very thin strips of electrical-engineering steel .... See Entry 68558

Passive and enhanced grain boundaries in solar cells by gas immersion laser diffusion .... See Entry 68893

61.70Y Interaction between different crystal structure defects

67030 Inner differentiation of growth sectors induced by the interaction between dislocations and sector boundaries in KH_2PO_4 crystals. C.Belouet (Labs. d'Electronique et de Phys. Appl., Limeil-Brevannes, France), E.Dunia, J.F.Petroff, M.Sauvage.
J. Cryst. Growth (Netherlands), vol.61, no.2, p.383-92 (March 1983).
Single crystals of KDP and DKDP give a strong electro-optical effect at temperatures close to their Curie point. This property is the basis for the use of DKDP as a solid-state light modulator for large-screen display devices. However, electrical conductivity heterogeneities in these crystals eventually impair the performances of the devices. The authors report on a remarkable differentiation in electricl conductivity in polyhedral-shaped regions which result from the interaction of a dislocation line with the boundary between pyramidal sectors. A close correlation is established between the lattice dilation and the electrical conductivity differentiation in these polyhedral regions as estimated by plane-wave X-ray topography and electroding decoration techniques. A phenomenological interpretation for both the genesis of the polyhedral defects and their physical properties is proposed. (14 refs.)

67031 Influence of the orientation of anisotropic impurity-vacancy complexes upon dislocation charging in NaCl crystals. E.L.Andronikashvili, M.V.Galustashvili (Inst. of Phys., Acad. of Sci., Tbilisi, Georgian SSR).
Phys. Status Solidi b (Germany), vol.116, no.1, p.335-8 (1 March 1983).
Electrical effects are investigated observed during charged dislocation motion in NaCl crystals containing impurity-vacancy dipoles oriented in an electric field ($E=12$ kV/cm). It is shown that the efficiency of dislocation charging, i.e. vacancy absorption from the dipole by the dislocation, depends on the mutual orientation of the dipole and the moving dislocation. The data obtained can be explained within a model taking into account both the elastic dislocation-dipole interaction and the electrostatic interaction of the dipole components of opposite charges. (9 refs.)

67032 Vacancy-dislocation interaction energies in MgO. A re-analysis. M.P.Puls (Whiteshell Nuclear Res. Establ., AECL, Pinawa, Manitoba, Canada).
Philos. Mag. A (GB), vol.47, no.4, p.497-513 (April 1983).
Atomistic calculations of the energy of interaction of anion and cation vacancies with an $a/2[110](1\bar{1}0)$ edge dislocation in MgO have been carried out using the breathing-shell model. This is an extension of previous calculations (see ibid., vol.41, p.353, 1980, and J. Phys. (France), vol.42, p.13, 1981) carried out with the shell and point-ion models. Comparison of the results, obtained for a small number of defect locations around the dislocation's centre, shows only small differences among the models, indicating that for MgO the point-ion model is sufficiently accurate. A calculation of the volume of formation of Schottky defects in MgO carried out with the two shell models, using the volume derivative method, gives roughly comparable results. For Schottky defects, the relaxation volume varies from 0.36 to 0.52 molar volumes, which is close to the volume determined by Sangster and Rowell (1981), using a similar method of calculation but with a slightly different potential. An error in the program PDINT used to calculate interaction energies has been corrected, and previously published interaction energies, for an extended region surrounding the edge dislocation, have been re-evaluated. (17 refs.)

67033 Kinetics of hydrogen-monovacancy interactions in metals. R.B.McLellan (Dept. of Mech. Engng. & Materials Sci., William Marsh Rice Univ., Houston, TX, USA).
Scr. Metall. (USA), vol.17, no.3, p.417-20 (March 1983).
Presents a calculation of the diffusion coefficient of an interstitial species in a lattice containing monovacancies and shows how the corresponding predictions may be related to experimental measurements. The results are compatible with a simple defect trapping mechanism, but this conclusion is tentative due

to the uncertainty in the actual effects of neutron irradiation in Mo and the interesting discovery that the H-diffusivity is enhanced in Pt. (8 refs.)

Effect of Z_1 centres on the isothermal stability of colour centres in microcrystalline powder of KCl ....See Entry 66988

Point defects and effective activation parameters for motion of dislocations in Ge and Si at low stresses ....See Entry 66991

Interaction of dislocations and deformation hardening of the ordered CuAu alloy ....See Entry 66992

Influence of the medium on the distribution of dislocations near a surface parallel to the Burgers vector in deformed LiF crystals .... See Entry 67003

Surface restoration of oxygen-implanted silicon ....See Entry 67024

Influence of lithium and sodium on radiation defect formation in a KDr crystal in the temperature region 4.2-300K .... See Entry 67046

Trapping of impurity atoms by defects and the distribution of clusters during ion bombardment of growing films .... See Entry 67065

Hydrogen motion in single-crystal palladium hydride as studied ultrasonically .. ..See Entry 67117

Direct analysis of the structure, concentration, and chemical activity of surface atomic vacancies by specialized low-energy ion-scattering spectroscopy: TiC(001) ....See Entry 67321

Effects of pre-irradiation and quenching on the low-temperature thermoluminescence of KCl:Sr .... See Entry 68334

61.80 RADIATION DAMAGE AND OTHER IRRADIATION EFFECTS

(for techniques of structure determination, see 61.10 to 61.16; for electron and ion impact phenomena, see 79.20)

67034 Radiation induced soft fails in space electronics. E.L.Petersen (Naval Res. Lab., Washington, DC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1638-41 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Advanced microelectronic circuits are sensitive to the passage of single ionizing particles. These circuits store information so that the deposition of a small charge (picocoulomb range) can charge a storage node, resulting in a bit error. This effect presents a problem to computer memories, on Earth because alpha particles are emitted from microelectronic packages and materials. The problem is much more severe in space due to primary cosmic rays and to nuclear reactions in the device produced by protons from the Earth's radiation belts. A number of satellite systems have been severely affected by single event soft-fails. (10 refs.)

67035 Analysis of thermal stresses induced in silicon during xenon arc lamp flash annealing. G.G.Bentini, L.Correra (Inst. LAMEL-CNR, Bologna, Italy).
J. Appl. Phys. (USA), vol.54, no.4, p.2057-62 (April 1983).
Evaluation of thermal stresses induced on silicon wafers during flash annealing with incoherent light from a xenon lamp has been performed. The thermally induced stresses have been computed taking into account that the slip planes, in ⟨100⟩ silicon crystal, are {111} and the slip directions in the plane are ⟨110⟩. The computed stresses have been compared with the yield stress of the material, to determine the threshold of damage introduction by the annealing process. For the light flash durations shorter than 500 μsec, a preheating of the sample is necessary to obtain a good annealing of a 1000 Å implanted layer without defect introduction. A relationship between flash duration, preheating temperature and flash energy density has been established following the identification of the best annealing conditions. The computed results have been compared with experimental annealing data obtained on ⟨100⟩ silicon, phosphorus implanted at 10 keV, 1.5×10^{15} at/cm^2 and irradiated with an original flash annealing system set up in the authors' laboratory. (18 refs.)

67036 Low temperature irradiation of amorphous Fe-B alloys. A.Audouard (INSTN, CENS, Gif-sur-Yvette, France), J.C.Jousset.
J. Phys. Colloq. (France), vol.43, no.C-9, p.423-6 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Amorphous alloys $Fe_{80}B_{20}$, $Fe_{75}B_{25}$ and their crystallized counterpart Fe_3B have been irradiated at low temperature ($\sim$20K) with different particles. From the experimental results it can be assumed that irradiation induces the creation of localized point defects and disordering. For the most energic particles there is a competition at 30K between crystallization and amorphization. (5 refs.)

67037 The effect of UV irradiation on films made of PVC containing small amount of modifying copolymers. A.Kaminska (Inst. Chem., Univ. of Mikolaja Kopeknika, Torun, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.27, no.2, p.59-62 (Feb. 1982). In Polish. [received: March 1983]
The changes in physicochemical and mechanical properties caused by UV irradiation of a packaging film made of PVC with added copolymers of the type: VC-VAc, MBs and an acrylic resin (Paraloid) have been investigated. By evaluating the extent of changes in solubility, permeability and color it has been demonstrated that the presence of these copolymers in the film contributes to an increase in the UV-sensitivity of PVC. It has also been found that crosslinking of PVC results in a decrease of permeability, tensile strength and elongation at break of the film. The numerical values characterizing the two last-mentioned properties decrease rapidly after appearance of gel, whereas their maximum values are observed just before its appearance. Thus, at crosslinking density of PVC below 1 the effect of crosslinking on these properties is positive and at crosslinking density above 1—negative. (16 refs.)

67038 Two-component cascades of collisions. I.A.Akhiezer, Z.A.Spol'nik.
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1810-11 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3188-90 (Oct. 1982). [received: April 1983]
The authors generalise the simplified method developed by Akhiezer et al. (1975) to the case of a two-component cascade. They give some estimates for cascades in uranium dioxide UO_2. (7 refs.)

67039 Guide to the effects of nuclear irradiation on materials, electronic and electrical components, oils and greases. R.C.E.Lewis.
Report SRD R 249, UKAEA, Culcheth, Lancs., England (March 1983), 17 pp.
It is impossible in a short report to give details of the effects of irradiation on each component or material and there are some discrepancies in the threshold levels quoted in the literature. There is, however, general agreement regarding the level of radiation at which there is some change (usually deterioration) in the normally accepted performance. Where components are required to operate in the immediate vicinity of radiation fields of upwards of 10^5 Rads, the potentially damaging threshold levels are shown. It is concluded from a study of the information available that the specification for plant, and components in chemical plants which handle radioactive materials need be no different from other plants. (12 refs.)

Numerical treatment of the cladding mechanics in the fuel rod computer code IAMBUS ....See Entry 65311

The development and testing of SYNROC C as a high level nuclear waste form ....See Entry 65368

Radiation induced sodium metal colloid formation in natural rock salt from different geological localities .... See Entry 65403

Solidification of radioactive wastes with thermosetting resin ...See Entry 65407

The chemical durability of some HLW glasses: effects of hydrothermal conditions and ionising radiation ....See Entry 65458

Scattering studies of photo-structural changes in chalcogenide glasses ....See Entry 66858

The influence of melting condition on the radiation sensitivity of GeO_2 glass ... .See Entry 66873

Effect of light on structural relaxation in vitreous selenium thin films ....See Entry 66885

Effect of water content on properties of Na_2O3SiO_2 glasses ...See Entry 66889

Impurity atoms in germanium as recombination centers for primary radiation defects ....See Entry 66980

Irradiation-driven phase transformations in alloys .... See Entry 67161

ESR studies of radiation-induced tin centers in oxide glasses . See Entry 68012

Dynamics of radiation-induced charging and discharging of foil electrets ....See Entry 68111

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

Radiation and spectral characteristics of sapphire crystals produced by various methods ....See Entry 68254

61.80B Laser beams

67040 Current-assisted laser annealing of polysilicon films. K.Okamoto, H.Suzunaga (Univ. of Electro-Communications, Tokyo, Japan).
Appl. Phys. Lett. (USA), vol.42, no.9, p.809-11 (1 May 1983).
The authors suggest the current-assisted laser annealing of polysilicon films deposited on SiO_2 by chemical vapor deposition of silane. A *Q*-switched ruby laser was irradiated to polysilicon films with applying an electric field. Then, a large photocurrent flowed through the films during the laser irradiation, and the resistivity of the polysilicon films decreased drastically from $\sim 10^8$ to $\sim 10^4$ Ω cm by the current-assisted laser annealing, while the resistivity decreased only to $\sim 10^6$ Ω cm in the case of the conventional laser annealing (zero electric field). The effects of the applied electric field on the annealing are due to the local heating at the grain boundaries and the promotion of the coalescence among the grains. (9 refs.)

67041 Lateral dopant transport during laser recrystallization of polysilicon. T.I.Kamins (Hewlett-Packard Labs., Palo Alto, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.832-4 (1 May 1983).
Significant lateral dopant transport occurs during seeded laser recrystallization of polysilicon. Both spreading-resistance measurements and voltage-contrast scanning electron microscopy show that phosphorus, arsenic, and boron are transported several tens of microns in the direction of the beam travel during recrystallization, while much less transport is observed in the other directions. The dopant motion orthogonal to the beam scan is consistent with liquid-phase diffusion. (7 refs.)

67042 Effect of pulse laser emission on mercuric telluride. I.V.Kurilo, S.G.Kiyak, I.P.Palivoda (Lenin Komsomol Lvov Polytech. Inst., Lvov, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.783-6 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.935-8 (June 1982). [received: Feb. 1983]
It was established that secondary crystallization after irradiation of HgTe single crystals leads to the formation of single-crystal layers with the same unit cell parameters as those observed prior to irradiation. An increase in the concentration of the vacancies is observed in the case of HgTe samples of the p-type, while conversion of the type of conductivity is observed in the case of samples of the n-type. The mechanical properties of the surface of recrystallized layers are irregular, and this should be taken into account in the creation of structures based on HgTe with the aid of laser technique. (4 refs.)

67043 The properties of crystalline silicon under laser irradiation. R.Car, A.Selloni, J.F.Janak, S.T.Pantelides (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1007-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The initial effect of laser irradiation is the excitation of electron-hole pairs. It has not, however, been established whether the excited electrons transfer their energy to the lattice rapidly (leading to thermal annealing), or retain it for long times (leading to annealing caused by the softening of the lattice resulting from the presence of the excited electrons). The authors use parameter-free, self-consistent calculations to investigate the consequences of large concentrations of excited electrons in the absence of energy transfer to the lattice. They assume that the excited electrons reach thermal equilibrium among themselves. The valence-band density of states remains essentially unchanged and it is concluded that the observed large changes in the valence photoemission spectra cannot be attributed to the presence of excited electrons, but are more likely due to surface reconstruction. The lattice contracts for all but extremely high concentrations of excited electrons. This result supports Gauster's analysis of his experimental data, according to which electronic contraction occurs at low levels of excitation, whereas, at higher levels of excitation, the observed dilation is due to transfer of energy from the electronic system to the lattice. Finally, the authors discuss the relevance of their results to more recent suggestions about the role of the excited electrons during laser annealing. (15 refs.)

67044 Pulsed laser annealing of semiconductors. Experimental facts and open questions. H.Kurz (Philips GmbH Forschungslab., Hamburg, Germany), J.M.Liu, N.Bloombergen.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1010-13 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The main experimental facts about pulsed laser annealing of ion-implanted semiconductor surfaces are summarized, and some questions of basic scientific

interest are discussed. Special attention is paid to a series of experiments, where the interaction of single-crystal silicon with picosecond laser pulses is studied systematically. The growing evidence for the validity of a simple thermal model is reviewed within the framework of these results, which deliver decisive experimental data for the discussion of the energy transfer routes on a ps time scale. (23 refs.)

67045 **CO_2 laser oxidation of silicon.** I.W.Boyd, J.I.B.Wilson (Heriot-Watt Univ., Edinburgh, Scotland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1030-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A CW CO_2 laser has been used to grow small silicon oxide deposits on heated Si wafers. These oxides have similar electrical properties to furnace-grown SiO_2, and have been used in rectifying diodes. Their infrared absorption band at 1070 cm^{-1} is narrower than for conventional SiO_2 on Si wafers, and their refractive index is 1.465 ± 0.01 for thicknesses of 40 nm to 140 nm. (8 refs.)

Optimal regime for forming topological patterns when processing films with laser radiation .... See Entry 66319

Rutherford backscattering evidence for solid phase laser annealing of Corning 7059 glass and ZnO thinfilsm .... See Entry 66359

Ag photodoping of amorphous chalcogenides .... See Entry 66850

Channeling contrast microscopy: Application to semiconductor structures .... See Entry 67069

Ion beam crystallography of the Si(111)-(7×7) and (1×1) surfaces .... See Entry 67322

Theory of photodesorption of molecules by resonant laser-molecular vibrational coupling .... See Entry 67354

Formation of AlSb by laser and capacity discharge annealing .... See Entry 67405

Formation of *p-n* junctions in *n*-type InSb by pulsed laser radiation .... See Entry 67771

Time-resolved optical measurement of Si lattice temperature during nanosecond pulsed laser annealing .... See Entry 68162

Observation of a Soret-Dufour effect for laser-generated carriers in germanium .... See Entry 68224

Non linear photoemission from silicon .... See Entry 68401

Laser processing of thin surface layers in semiconductors .... See Entry 68676

61.80C X-rays

67046 **Influence of lithium and sodium on radiation defect formation in a KDr crystal in the temperature region 4.2-300K.** A.K.Dauletbekova, A.T.Akilbekov, A.A.Elango (Inst. of Phys., Acad. of Sci., Tartu, Estonian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1654-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2920-4 (Oct. 1982). [received: April 1983]
The generation of radiation defects (F-H and α-I pairs) by X-rays in KBr with varying Li and Na concentrations (from 10^{-4} to 1 mole %) is investigated by absorption in the temperature region 4.2-200K. The influence of the impurities at different temperatures is established: at 4.2K impurities capturing excitons suppress the generation of both F-H and α-I pairs; in the temperature region between the delocalization of the H centers and that of the H_A centers (50-230K in KBr-Li) impurities localizing H_A centers decrease the separation into F-H_A pairs, increasing the efficiency of F-$H_A \rightarrow \alpha$-I conversion, and suppress the association of H centers; at 300K the impurities mostly influence the association of H centers. (17 refs.)

Hole-burning Stark spectroscopy of the 5770 Å colour centre in NaF .... See Entry 66986

Geometric model of trapped electrons in trehalose single crystals X-ray irradiated at 3K. An EPR study .... See Entry 68024

Investigation of recombination processes in KCl:Tl crystals by optical detection of EPR .... See Entry 68086

Effects of pre-irradiation and quenching on the low-temperature thermoluminescence of KCl:Sr .... See Entry 68334

Glow curves of thermally pre-treated NaCl:Ca crystals .... See Entry 68335

61.80E Gamma rays

67047 **Gamma irradiation induced photochemical reactions in V-doped borate glasses.** M.M.Morsi, E.M.H.Ibrahim, A.M.Nassar (Nat. Res. Centre, Cairo, Egypt).
J. Solid State Chem. (USA), vol.47, no.2, p.201-9 (April 1983).
Glasses of the composition $X Na_2O.4Al_2O_3(96-X)B_2O_3$(mole%) where $X=10$, 20, 30 to which 0.03 g V_2O_5 per 100 g glass was added, were prepared by normal melting. Their absorption characteristics together with the corresponding v-free base glasses were determined before and after gamma irradiation. The characteristic spectra of the unirradiated glasses show absorption bands at 315, 470, 560-580, 610-650, 700-870, and 860-1000 nm, indicating the presence of vanadium ions in more than one oxidation state, namely V^{5+}, V^{4+}, and V^{3+}. Gamma irradiation of V-containing glasses causes the formation of color centers in the glass matrices, with absorption bands at 330, 500, and 610 nm, and photoreduced $[V^{3+}]$ and $[V^{2+}]$ ions with absorption bands at 350-355 and 530-570 and 520 nm, respectively. Photoreduced $[V^{4+}]$ may also be formed, giving rise to absorptions at 690-700 and 750-800 nm. The induced vanadium ions are found to absorb at shorter wavelengths than the intrinsic ones. An explanation based on the difference in the field energy of the two states is given. (21 refs.)

The effect of radiolysis on leachability of plutonium and americium from 76-101 glass [radioactive waste] .... See Entry 65431

Effects of alpha, gamma, and alpha-recoil radiation on borosilicate glass containing Savannah River Plant defense high-level nuclear waste .... See Entry 65433

The influence of gamma irradiation on the leaching behavior of a modified SYNROC-B ceramic waste form .... See Entry 65439

Study of structural relaxation induced by irradiation of Se glass by measuring the micromechanical properties .... See Entry 66891

Effect of Z_1 centres on the isothermal stability of colour centres in microcrystalline powder of KCl .... See Entry 66988

The effect of γ-irradiation on amorphous silicon field effect transistors .... See Entry 67588

Paramagnetic species in NaCl:Ca,Cu crystals irradiated at RT .... See Entry 68008

ESR studies on arsenic-associated centers in oxide glasses produced by gamma-irradiation .... See Entry 68014

Action of ionizing radiation on the IR absorption spectra of NaF and LiF crystals .... See Entry 68273

61.80F Electrons and positrons

67048 **Treatment of metals by a beam of electrons for obtaining products with the properties of a bimetal.** E.S.Machurin, G.M.Lonchin, A.N.Shiryaeva, A.V.Gryzlov.
Elektron. Obrab. Mater. (USSR), no.1, p.24-7 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
The thermosensitive characteristics of an alloy, compositionally close to alloy 32NK, after it had been irradiated by electrons were investigated. It is shown that after this treatment the coefficients of thermal expansion of the irradiated and unirradiated parts of the alloy differ by more than an order. Hence a plate or blade, half of which has been treated by a stream of electrons, can act as a thermosensitive element. The transition zones between irradiated and unirradiated portions were studied. (1 ref.) *A.J.B.*

67049 **Radiation-induced crystallinity changes in linear polyethylene.** S.K.Bhateja (Saran & Converted Products, Dow Chem. Co., Midland, MI, USA), E.H.Andrews, R.J.Young.
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.523-36 (April 1983).
Two kinds of ultrahigh-molecular-weight linear polyethylene (UHMW PE), together with conventional high-density polyethylene (HDPE), were subjected to β irradiation, and changes in their properties were monitored. Elastic modulus increased steadily with dose for all materials, as did the yield stress. A dramatic rise of density with dose was observed in the UHMW PE specimens accompanied by a corresponding increase in heat of fusion, X-ray crystallinity, and peak melting temperature. The magnitude of such changes in HDPE was much smaller. In UHMW PE specimens, the X-ray long period simultaneously decreased but crystal thickness remained constant. No changes in long period occurred in HDPE. The effects are attributed to the scission of tie molecules in UHMW PE followed by a growth in the perfection of the crystal lamellae and suggest a method for assessing the tie-molecule content of such materials. (23 refs.)

67050 **Morphological change in agglomerated gold films during electron beam irradiation.** B.G.Atabaev, S.S.Elovikov, A.S.Ovsyanitskii (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1541-3 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2719-23 (Sept. 1982). [received: April 1983]
The morphological change occurring in agglomerated gold films of 1.5, 4.5 and 6.0 nm effective thickness is investigated during electron beam irradiation with energies E_i=600-3000 eV at a beam density j=5 A m^{-2} and doses $D \sim 10^{22}$ m^{-2}. It is shown that the irradiation effect depends upon the initial film structure and the surface charge distribution. (11 refs.)

67051 **Decay of electronic excitations at pairs of charged Frenkel defects in KI.** V.M.Lisitsyn, V.I.Sigimov, V.Yu.Yakovlev (S.M. Kirov Polytech. Inst., Tomsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1555-8 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2747-52 (Sept. 1982). [received: April 1983]
Using pulsed absorption spectroscopy with nanosecond time resolution the authors have studied the kinetics of the generation and decay of α and *F* color centers in crystalline KI when it is acted upon by a 10 nsec pulse of accelerated electrons. They have shown that, in addition to *F* centers, α centers are created as primary products of the decay of electronic excitations. At 80K the generation of α centers dominates. As the temperature is increased over the range 80-300K the efficiency for α center generation increases with an activation energy of 17 meV. A model is proposed for the formation of an α-I pair of defects, via decays of a dihalide self-localized exciton, which satisfactorily describes the experimental results. (12 refs.)

Effects of alpha, gamma, and alpha-recoil radiation on borosilicate glass containing Savannah River Plant defense high-level nuclear waste .... See Entry 65433

Radiation effects in nuclear waste glasses .... See Entry 65435

Surface recombination velocity in a silicon optical waveguide ..See Entry 66383

X-ray investigation of electron-irradiated quartz .... See Entry 66965

Huang-scattering from self interstitials in electron-irradiated Fe-40 at.% Al ordered alloy .... See Entry 66982

Self-interstitial atoms, vacancies and their agglomerates in electron-irradiated nickel investigated by diffuse scattering of X-rays .... See Entry 66983

Recombination enhanced dislocation glide in InP single crystals .... See Entry 66994

Boron diffusion during electron pulse annealing of silicon .... See Entry 67287

Alkali migration in glasses on electron, proton and heavier ion irradiation .... See Entry 67288

Formation of $MoSi_2$ by pulsed electron beam irradiation onto a vapor deposited molybdenum/silicon structure .... See Entry 67375

Microstructural features of Zircaloy-2 and stainless steel AISI-304 L electron beam joint .... See Entry 67376

Electrical transport in electron beam irradiated polyacetylene .... See Entry 67575

Electron beam induced conductivity in 'PET' and 'FEP' .... See Entry 67646

Pulsed electron beam annealing of ion implanted germanium for photovoltaic devices .... See Entry 67774

Complex isotope splitting of the no-phonon lines associated with exciton decay at a four-lithium-atom isoelectronic centre in silicon .... See Entry 68304

61.80H Neutrons

67052 **Efficiency of formation of paramagnetic defects in silicon by neutron irradiation.** A.Kh.Antonenko, A.V.Dvurechenskii, L.S.Smirnov, V.A.Kharchenko (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1302-4 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2018-21 (Nov. 1982). [received: April 1983]
A study was made of the accumulation of vacancy and interstitial defects, and of vacancy-oxygen complexes in silicon irradiated with neutrons

($T_{irr} \lesssim 60°C$). The defect concentration was proportional to the neutron dose right up to doses of $\phi \approx 5.10^{18}$ cm^{-2}; in the range $\phi > 10^{19}$ cm^{-2} the efficiency of formation of paramagnetic centers decreased and the concentration of these centers tended to the following limiting values: $\sim 2.10^{16}$ cm^{-3} for tetravacancies and diinterstitials and $\sim 1.10^{16}$ cm^{-3} for complexes consisting of two vacancies and an oxygen atom. In the case of interstitial defects the saturation of the dose dependences was observed earlier than in the case of the vacancy complexes. A comparison of the results obtained with the data of ion bombardment experiments indicated that amorphization of silicon could not be achieved by neutron irradiation. (15 refs.)

67053 Liberation of helium in the heating of irradiated boron carbide. V.G.Kovyrshin.
Sov. At. Energy (USA), vol.53, no.2, p.570-1 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.112-13 (Aug. 1982). [received: April 1983]
Radiation damage to boron carbide is produced primarily by the formation and accumulation of helium atoms. The interaction of these atoms with the original and radiation defects at increased temperatures promote an escape of helium to the surface and diffusion into the material, which is accompanied by the formation of gas porosity and swelling. Therefore, special attention is being paid to the investigation of the behavior of helium in boron-containing materials. The authors studied the kinetics and determined the energy characteristics of processes of thermal desorption during the heating of irradiated samples of unenriched boron carbide. (7 refs.)

Irradiation creep in the fusion reactor first wall .... See Entry 65666

Influence of preliminary neutron irradiation upon helium blistering in OKh16N15M3B steel ....See Entry 65673

Amorphization of silicon oxynitride irradiated with fast neutrons; study by infrared spectrometry ....See Entry 66839

Capacitance spectroscopy investigation of defects formed in *n*-type silicon by neutron irradiation ....See Entry 67535

61.80J Ions

(for ion implantation, see 61.70T)

67054 Ion-induced amorphous and crystalline phase formation in Al/Ni, Al/Pd, and Al/Pt thin films. L.S.Hung, M.Nastasi, J.Gyulai, J.W.Mayer (Dept. of Materials Sci. & Engng., Cornell Univ., Ithaca, NY, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.672-4 (15 April 1983).
Amorphization by ion beam irradiation of multilayered samples of Al/Pt, Al/Pd, and Al/Ni has been investigated by selected area diffraction and Rutherford backscattering. With a dose of 2×10^{14} Xe ions/cm^2, uniform mixing is achieved in the Al/Pt system and the amorphous phase is produced over a large composition range. In the Al/Pd and Al/Ni systems, amorphous phases or the equilibrium, crystalline phases are formed depending on the composition of the films. The same results were found when the samples were annealed to form crystalline phases before bombardment. For thin films of these FCC metals, only the simplest intermetallics, NiAl and PdAl, (primitive cubic structures with 2 atoms/cell) were formed in crystalline form by ion-beam irradiation. (9 refs.)

67055 In situ studies of the effects of ion beams on materials using the electron microscope ion beam interface. S.Ishino, H.Kawanishi, K.Fukuya, T.Muroga (Dept. of Nuclear Engng., Univ. of Tokyo, Tokyo, Japan).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1255-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
To investigate microstructural evolution by cascade damage produced by energetic heavy particles, the authors have built a facility which is capable of observing damaged structure introduced by heavy ions in situ in an electron microscope. A 400 kV Cockcroft-Walton type heavy ion accelerator with a Danfysik 911A heavy-ion source has been combined with a 200 kV electron microscope. Heavy ion beams of energies up to 400 keV can bombard the specimen in the microscope with an incident angle of 45 degrees to the electron beam axis. This paper describes the outline of the facility and some of the recent results mainly concerned with heavy radiation damage of materials which are relevant to fast breeder and fusion reactor development. (14 refs.)

67056 Recent work using the ANL HVEM-ion beam interface. A.Taylor, E.A.Ryan (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1263-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The ANL-Materials Science and Technology Division High Voltage Electron Microscope-Tandem Facility is a unique national research facility for in-situ studies of the interaction of energetic particle with solids. The ion-beam interface permits ion beams from either a 300-kV Texas Nuclear or a 2-MV National Electrostatics Tandem accelerator to be transported into the stage of the Kratos EM7 1.2-MV HVEM. The current status of research projects employing the ion-beam interface is reported. (2 refs.)

67057 Damage analysis and atom site determination in ion-implanted GaAs using low energy proton channeling and PIXE. P.P.Pronko, R.S.Bhattacharya (Universal Energy Systems Inc., Dayton, OH, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1709-12 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The use of proton channeling and proton induced X-ray excitation (PIXE) for damage analysis and lattice location measurements is reviewed with emphasis given to those aspects of the measurements that relate backscattering to X-ray excitation. Angular scan curves from backscattering spectra are compared to those of PIXE spectra and discussed in terms of exact versus nonexact substitutionality. Details concerning the energy dependence of X-ray production, matrix absorption, and depth dependent cross sections are presented and their significance to damage measurements assessed. Examples are given of damage analysis and substitutionality measurements for sulfur implanted in GaAs. The use of PIXE for measuring relative displacement rates for Ga and As in ion irradiated GaAs are also discussed. (9 refs.)

67058 The effect of preinjected gas atoms on depth dependent damage in self-ion irradiated nickel. D.B.Bullen, J.H.Billen, G.L.Kulcinski (Nuclear Engng. Dept., Univ. of Wisconsin, Madison, WI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1743-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The effect of interstitial gas atoms on cavity formation in self-ion irradiated nickel specimens is studied utilizing a 700 keV accelerator to inject H$^+$ or He$^+$ ions into nickel foils. A tandem accelerator then irradiates the foils with 14-MeV nickel to produce displacement damage. Details of the irradiation facilities are presented. Sample preparation and analysis techniques are described. Preliminary results and plans for future experiments are described. (21 refs.)

67059 Effect of ion-beam damage on X-ray diffraction and Raman spectra of amorphous GeSe$_2$. M.Marcus, R.C.Dynes, J.E.Griffiths, D.McWhan (Bell Labs., Murray Hill, NJ, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1792-4 (April 1983).
Raman and X-ray measurements were done on amorphous GeSe$_2$ films before and after damage with 10^{177} α^+ cm^2. The first diffraction peak got smaller and shifted to higher wave vectors. The Raman spectrum did not change. The order seen as the first sharp diffraction peak may not be that manifested by the 'companion' Raman line. (7 refs.)

67060 A simultaneous study of lattice expansion and swelling in proton-bombarded GaP single crystals. C.Ascheron (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany), A.Schindler, V.Geist, G.Otto.
Radiat. Eff. Lett. (GB), vol.68, no.5, p.149-53 (1983).
The swelling and the lattice expansion of proton bombarded GaP single crystals are simultaneously measured for different proton doses by the 'Talystep' method and by the Kossel technique, respectively. The results reveal a good agreement between the increase in interplanar spacing and the volume change in the damaged region. (21 refs.)

67061 The analysis of Rutherford scattering-channelling measurements of disorder production and annealing in ion irradiated semiconductors. G.Carter, R.G.Elliman (Dept. of Electronic & Electrical Engng., Univ. of Salford, Salford, England).
Radiat. Eff. Lett. (GB), vol.68, no.5, p.155-67 (1983).
Study of the observed backscattering signal, either from fixed depth or depth integrated, as a function of implant ion fluence, has been used to infer, qualitatively, the nature of the disorder production for a variety of energy deposition density conditions in Si and GaAs implanted $\sim$40K to minimise annealing processes. These processes range from simple defect accumulation until a sufficiently high local defect density is reached with increasing fluence that relaxation to amorphousness occurs to direct impact amorphisation in individual cascades where defect densities are sufficiently large to cause instant collapse to amorphousness. RBS/channelling results of log (yield) as a function of log (implant fluence) can be used to distinguish probable disordering mechanisms, to estimate disorder densities required for amorphousness collapse and to investigate thermal annealing processes. (13 refs.)

67062 Stoichiometry effects at NiMo surfaces under bombardment with Ar$^+$ ions from 40 to 2000 eV. J.Bartella, H.Oechsner (Fachbereich Phys., Univ. Kaiserslautern, Kaiserslautern, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.581-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The stoichiometric variations at and below the surface of a polycrystalline 79.2Ni-20.8Mo alloy being induced by normal bombardment with Ar$^+$ ions of 40 to 2000 eV have been investigated with AES. A special plasma arrangement was used as a laterally homogeneous ion source. The depth dependent compositional variations in the uppermost atomic layers are derived from the different behaviour of the individual Auger peaks as a function of the energy of bombarding ions. The sputter induced elemental depth distributions are, additionally, sputter depth profiled with 50 eV Ar$^+$ ions. The elemental concentration profiles display a pronounced enrichment of the Mo component in the damaged surface region. With increasing E_0 the maximum of the bombardment induced Mo concentration profile is shifted to a distance up to several atomic layers below the surface. The results supply not only detailed information on bombardment induced stoichiometric changes with depth, but also on the size and the shape of the atomic collision cascades in sputtering. (7 refs.)

67063 Influence of the degree of doping of a semiconductor on the redistribution of boron in silicon as a result of high-temperature proton irradiation. V.V.Kozlovskii, V.N.Lomasov, G.M.Gur'yanov, A.P.Kovarskii.
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1350-1 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2089-90 (Nov. 1982). [received: April 1983]
Investigates a redistribution of boron in homogeneously doped silicon. When the dopant concentration was below 10^{18} cm^{-3}, a maximum impurity distribution was observed in the region at the end of the proton range (R_p) instead of the usual minimum found in samples in which the overall impurity concentration was higher. The impurity concentrations in the samples ranged from 1.5×10^{17} to 2.5×10^{19} cm^{-3}; the other factors influencing the nature of the process of impurity redistribution (proton energy and current density, irradiation temperature) were kept constant. (7 refs.)

67064 Irradiation of diamond by α-particles from ^{244}Cm. V.G.Gordeev, V.A.Nikolaenko, S.V.Pirozhkov, I.K.Shvetsov.
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1362-3 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2215-17 (Nov. 1982). [received: May 1983]
The use of α radiation from transuranic elements is combined with X-ray techniques directly during irradiation to study how radiation-induced defects alter the properties of materials. An experiment is described in which diamond powder is irradiated by α particles from ^{244}Cm and the change in the unit cell parameter in diamond as a function of the radiation dose is reported. (4 refs.)

67065 Trapping of impurity atoms by defects and the distribution of clusters during ion bombardment of growing films. T.D.Radzhabov, Z.A.Iskanderova, E.O.Arutyunova, K.R.Samigulin (U.A. Arifov Inst. of Electronics, Acad. of Sci., Tashkent, Uzbek SSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1375-9 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2238-44 (Nov. 1982). [received: May 1983]
Trapping of gaseous impurity atoms by defects during growth is treated from a theoretical standpoint when ion implantation is accompanied by simultaneous diffusion. Density profiles are determined analytically and by numerical analysis for the impurity-defect clusters as a function of distance in the film and substrate, and the main features of trapping of impurity particles by defects are determined over a wide range of experimental parameters. The effects of impurity trapping by defects on the magnitude and distribution of the total impurity atom density and on the total rate at which the bombarding ions are absorbed in the film are studied. It is shown how to obtain films with a high and nearly uniform impurity-defect cluster density under typical experimental conditions and how to increase the total absorption of gas impurity by using films with an increased density of impurity-trapping defects. (17 refs.)

67066 Sputtering of the surface of gold by fission fragments. V.V.Obnorskii, I.A.Baranov, N.V.Badadzhanyants, B.G.Yarullov.
Sov. At. Energy (USA), vol.53, no.2, p.559-60 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.105-6 (Aug. 1982). [received: April 1983]
Both bulk samples (foil 20 μm thick) and thin, finely granular layers deposited by thermal sputtering in a vacuum on substrates made out of a dielectric (glass) and a metal (platinum) have been used in connection with the determination of the sputtering coefficients K of gold by fission fragments from an external source. In order to clarify the sputtering mechanism of bulk gold by heavy, multiply-charged ions of the fission-fragment type, the dependence of K on the variation of the mean fragment energy has been investigated. (8 refs.)

67067 Estimation of stacking-fault energy of Frank loops in OKh16N15M3B austenitic stainless steel. Yu.V.Konobeev, S.I.Rudnev.
Sov. At. Energy (USA), vol.53, no.2, p.563-4 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.107-8 (Aug. 1982). [received: April 1983]
Vacancy pores and dislocation loops form in OKh16N15M3B austenitic steel under bombardment with iron ions of an energy of 12-18 MeV in the internal beam of the U-300 cyclotron. Electron-microscope examination of the microstructure of steel irradiation with a damaging dose of 80 displacement/atom showed that dislocation loops are observed in the range 400-600°C. At a temperature above 450°C, all of the loops are prismatic, while the dislocation loops are primarily Frank loops. From observed data the authors estimate the stacking-fault energy of Frank loops. (4 refs.)

The effect of composition and radiation on the fracture of a nuclear waste glass .... See Entry 65338

Immobilization of high level nuclear reactor wastes in SYNROC: a current appraisal .... See Entry 65366

Alpha decay self-damage in cubic and monoclinic zirconolite . See Entry 65401

Application of ion beam techniques to the study of glass durability: enhanced dissolution in saline and radiation effects [radioactive waste] ...See Entry 65429

Leaching behavior of ion-implanted simulated HLW glasses and tentative prediction of their alpha-recoil aging .... See Entry 65430

Ion implantation studies of nuclear waste forms .... See Entry 65432

Effects of alpha, gamma, and alpha-recoil radiation on borosilicate glass containing Savannah River Plant defense high-level nuclear waste .... See Entry 65433

Point defects and microstructural stability of glasses under irradiation .... See Entry 65437

Radiation effects in radwaste glasses: a reappraisal of alpha-recoil aging as simulated by ion implantation .... See Entry 65438

Dynamic HVEM observations of metals and alloys during in-situ helium ion irradiations .... See Entry 65668

Surface irradiation damage of 316 stainless steel, vanadium and molybdenum by helium ion bombardment .... See Entry 65671

Influence of preliminary neutron irradiation upon helium blistering in OKh16N15M3B steel .... See Entry 65673

Characterization of disordered bonds in Si-implanted $Ga_{0.47}In_{0.53}As$ with laser Raman spectroscopy .... See Entry 67014

Progress in ion beam mixing .... See Entry 67017

In situ study of implantation-induced silicon amorphisation .....See Entry 67021

Study of ion-implanted damage in GaAs:Be and inP:Be using Raman scattering .... See Entry 67023

Effect of pressure differential on channeling in thin Si crystals .... See Entry 67068

Channeling effect of low energy boron implant in (100) silicon .... See Entry 67075

Incidence angle dependence of planar channeling in boron ion implantation into silicon .... See Entry 67076

Alkali migration in glasses on electron, proton and heavier ion irradiation .... See Entry 67288

Drastic reduction of adsorption of CO and H_2 on (111)-type Pd layers .... See Entry 67356

61.80M Channelling, blocking and energy loss of particles

(see also 29.70 Energy loss and range relations)

67068 Effect of pressure differential on channeling in thin Si crystals. R.B.Alexander, S.C.Johnson, K.R.Padmanbhan (Dept. of Phys. & Astron., Wayne State Univ., Detroit, MI, USA), J.C.Buchholz.
Appl. Phys. Lett. (USA), vol.42, no.9, p.804-6 (1 May 1983).
The effect on ion channeling in thin Si single crystals of distortion produced by a pressure differential has been investigated. At a threshold pressure of several Torr in a Si-air cell, an abrupt increase occurs in the channeling minimum yield. Measurements have been made of the distortion using reflection of laser light, which produces an unusual interference pattern. A geometric model is proposed in which the minimum yield is determined by the tilting of the channels perpendicular to the bowed crystal surface. (11 refs.)

67069 Channeling contrast microscopy: Application to semiconductor structures. J.C.McCallum, C.D.McKenzie, M.A.Lucas (School of Phys., Univ. of Melbourne, Parkville, Australia), K.G.Rossiter, K.T.Short, J.S.Williams.
Appl. Phys. Lett. (USA), vol.42, no.9, p.827-9 (1 May 1983).
A new technique is demonstrated for the imaging of semiconductor structures. The technique involves the use of a channeled $^4He^+$ microbeam, scanned across the surface to provide a channeling-contrast image of subsurface lattice disorder and atom location. The present arrangement provides a lateral resolution of ~5 μm and an in-depth resolution of ~30 Å. The technique is applied to the imaging of small, laser annealed regions on ion implanted silicon wafers. (12 refs.)

67070 Potential information and stopping power from channeling in diamond. R.D.Edge, R.W.Fearick, T.E.Derry, J.P.F.Sellschop (Nuclear Phys. Res. Unit, Univ. of the Witwatersrand, Johannesburg, S Africa).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1060-2 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
When a carefully cleaned diamond crystal was bombarded with helium nuclei parallel to a low index plane, up to seven peaks in the energy spectrum of backscattered ions were seen. These arose from particles oscillating to and fro across the channel as they progressed along it. Spectra taken with ions incident in different directions in the same plane allowed both the wavelengths of the oscillations in the channel, λ, and the stopping power within the channel to be obtained. The character of the oscillations changed as the beam deviated from exact alignment with the channel, giving the highest maximum at an angle ψ_m to the channel. Calculations based on those of Barrett (1979) employing λ, ψ_m, and the stopping power showed a smoother potential for the {111} planar channel, which has a larger spacing, than {100} and {110}. The energy dependence of the stopping power and oscillation wavelength was also determined from 0.2 to 1.2 MeV for the {110} planar channel. (9 refs.)

67071 Charge dependence of slow-ion energy losses in transmission experiments. J.Shchuchinsky, C.Peterson, W.Brandt (New York Univ., New York, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1063-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Modifications of the beam line, detector system, and use of Rutherford-scattered particles to correct for beam-current fluctuations, were made to increase the precision of heavy-ion energy-loss measurements in penetration experiments performed at the New York University Accelerator Facility. Ar^+, Ar^{++}, and Ar^{3+} ions were incident on the same domain of C, Al, and Au foils. The energy loss distributions of Ar^+, Ar^{++}, and Ar^{3+} ions after transmission through the foils were measured under identical conditions. The authors found an increase in the energy loss with increasing charge of the ions. The data are discussed in terms of the relation between the effective stopping-power charge of projectiles inside the solids and the ionic charge of particles incident on and emerging from the foils. (7 refs.)

67072 Range distributions of low energy ions in silver and copper. A.Zomorrodian, S.Tougaard, A.Ignatiev (Phys. Dept., Univ. of Houston, Houston, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1066-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Range distributions of 1-5 keV nitrogen ions in polycrystalline copper and silver substrates are measured and compared with available theories. The distribution consists of a surface localized peak, a shoulder/second peak and a long tail. The shoulder/second peak and tail are well explained by theories, however, the surface localized peak is a new feature for which several mechanisms have been investigated. (15 refs.)

67073 Stopping power for fast nitrogen and oxygen diclusters in carbon. M.F.Steuer (Univ. of Georgia, Athens, GA, USA), D.S.Gemmell, E.P.Kanter, E.A.Johnson, B.J.Zabransky.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1069-73 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Measurements of stopping powers for several diatomic ions are presented and compared to values derived from well known wake models. While independently determined wake forces can be superposed to calculate correctly the stopping forces on light fast ions, such as H_2^+, the method appears to be invalid for slower, more highly charged N_2^+ ions. To include non-linear terms in the interaction wake charge distributions must be determined for pairs of ionic cores. To avoid the complexities of a proper quantum mechanical treatment a semi-classical calculation of free electron scattering by two screened ionic cores was used to determine the stopping forces. While a quantum mechanical calculation is needed to obtain a definitive result the semi-classical calculation provides qualitative agreement with experiment for 3 MeV N_2^+ ions in carbon. (13 refs.)

67074 Some theoretical works on channelling effect and channelling radiation. Guozhu He, Guoju Hu (Dept. of Phys., Nankai Univ., Tianjin, China).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1726-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The trajectory equations for both relativistic and nonrelativistic channelling particles become very simple under general channelling conditions. For many potentials, such as Lindhard potential, the expressions of the trajectories can be obtained in closed form. The complete trajectory in the crystal can be traced out easily in both transverse and longitudinal directions. The backscattering probability as a function of the incident angles has been derived in this trajectory picture and is calculated for several cases: 3 MeV proton on Si(100), 1 MeV proton on Au(111), 1.5 MeV electron on Si(110) and 1 MeV electron on Ag(111). The shapes and widths of these theoretical curves fit well with the experimental results. The wave equations for the channelling relativistic electron and positron have been solved by WKB method. (12 refs.)

67075 Channeling effect of low energy boron implant in (100) silicon. T.M.Liu, W.G.Oldham (Dept. of Electrical Engng. & Computer Sci., Univ. of California, Berkeley, CA, USA).
IEEE Electron Device Lett. (USA), vol.EDL-4, no.3, p.59-61 (March 1983).
Unintentional ion channeling in low energy ion implantation of boron into (100) silicon results in much deeper junctions than predicted by Lindhard, Scharff, and Schiott (LSS) theory even for wafers tilted 8 degrees from the normal. Both B^+ and BF_2^+ implants show the effect. The characteristics of this partial channeling profile are discussed. An empirical formula is found to describe the enhancement of the junction depth. Experiments also show that the deep penetration tail can be suppressed by a silicon pre-implant to drive the silicon surface layer amorphous. (11 refs.)

67076 Incidence angle dependence of planar channeling in boron ion implantation into silicon. M.Miyake, M.Yoshizawa, H.Harada (Nippon Telegraph & Telephone Public Corp., Musashino, Tokyo, Japan).
J. Electrochem. Soc. (USA), vol.130, no.3, p.716-19 (March 1983).
A new method for estimating the channeling incidence angle dependence using *C-V* profiling technique was developed. Using this method, the incidence angle dependence of (110) planar channeling in boron implantation into silicon was studied. CZ, p-type, 75 mm diam, ⟨001⟩ oriented silicon wafers with 30~50 Ω cm resistivity were used. Boron was implanted into the wafers at 40~150 keV energy and 1×10^{12} cm^{-2} dose. (11 refs.)

67077 A semiclassical approximation for the Wigner distribution function. Application to planar channeling. V.G.Novitzky (Inst. of Metal Phys., Kiev, USSR).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.437-40 (4 April 1983).
Within the framework of the Wigner approach to the quantum mechanics of a single particle the semiclassical approximation for the distribution function in the case of planar channeling is obtained, based on iteration of the classical solution. Application of this method to other one-dimensional evolution problems is proposed. (12 refs.)

67078 Energy distribution measurements of 300 keV transmitted protons at the axial-to-planar channeling transition in silicon. Yu.V.Bulgakov, K.Lenkeit, R.Stolle (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K23-6 (1 March 1983).
During the transition of ions from axial to planar channeling their motion becomes unstable under special conditions thereby affecting the particle energy loss spectrum. The authors have measured the energy distributions of protons with initial energy E_0=300 keV which passed through a thin Si single crystal film under the conditions of transition from the axial ⟨110⟩ to planar (110) channeling. (5 refs.)

67079 The energy dependence of the angles of resonance dechanneling of ions in the ⟨110⟩→(110) axial-to-planar channeling transition in silicon. Yu.V.Bulgakov, K.Lenkeit (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K27-30 (1 March 1983).
The resonance dechanneling of fast ions in planar channels of a monocrystalline target occurs when the period of natural oscillations of particles becomes multiple to the time of their passage between the neighbouring atomic rows that form the walls of the planar channels. The authors present an experimental verification of the resonance conditions using hydrogen and helium ion channeling in Si monocrystalline films. (6 refs.)

67080 Stopping power for N^+ ions with energies from 160 to 440 keV in aluminium. S.V.Yalyshko (Nuclear Phys. Dept., Leningrad Polytech. Inst., Leningrad, USSR), R.Wedell.
Phys. Status Solidi b (Germany), vol.116, no.1, p.K47-50 (1 March 1983).
Results of stopping power measurements for N^+ ions in Al in the energy region 160 to 440 keV are reported. The influence of the Al layer thickness and the ion charge state on the experimental results and also the dependence of the electronic stopping power on the ion velocity are analyzed. The measurements were performed by the method of particle-induced X-ray emission (PIXE). (7 refs.)

67081 Projected ranges and effective stopping powers of electrons with energy between 20 eV and 10 keV. H.Iskef, J.W.Cunningham, D.E.Watt (Dept. of Medical Biophys., Univ. of Dundee, Dundee, Scotland).
Phys. Med. & Biol. (GB), vol.28, no.5, p.535-45 (May 1983).
Experimental projected ranges of electrons between 20 eV and 10 keV have been correlated by a simple scaling factor to yield 'best-fit' expressions applicable to all media. Extrapolated ranges, R_{ex} (in μg cm^{-2}) may be determined from the expressions given. From an analysis of the transmission curves, the following relation between median or mean projected ranges and the extrapolated ranges is obtained: $R_{50}=(0.3655\pm0105)\ R_{ex}{}^{1.024}$, 20 eV$\leq E\leq 10^4$ eV. Differentiation of the extrapolated range-energy expression yields an effective stopping power along the projected track of the electron and is given by: $dE/dR_{ex}=E/[R_{ex}(0.15546\ \ln(E)+0.31104)]$ eV cm^2 μg^{-1}, 20 eV$\leq E\leq 10^4$ eV with a precision of 30%. Improved accuracy of the experimental data is required for track structure applications and to resolve phase effects. (54 refs.)

67082 Electromagnetic radiation of relativistic channeling particles (the Kumakhov effect). V.V.Beloshitsky, F.F.Komarov (Inst. of Appl. Phys. Problems, Belorussian State Univ., Minsk, Belorussian SSR).
Phys. Rep. (Netherlands), vol.93, no.3, p.117-97 (Dec. 1982). [received: April 1983]
A new type of electromagnetic radiation characteristic for relativistic particles channeling in single crystals which has been recently predicted by Kumakhov and proved experimentally is reviewed. It is observed as one or several strong peaks in the soft part of the bremsstrahlung, surpassing it by a factor of nearly one hundred. At moderate electron energies sharp peaks corresponding to spontaneous transitions between quantum eigenstates of the channeling particles were detected. But for high energy channel electrons these peaks merge into one broad classical peak with the frequency determined by the collective potential of an atomic row or plane. This radiation strongly depends on the charge sign, velocity and mass of the particle. (176 refs.)

Radiative electron capture (REC) as an indicator of the K-vacancy state of highly ionized projectiles in solids: application to stopping power ....See Entry 66105

The analysis of Rutherford scattering-channelling measurements of disorder production and annealing in ion irradiated semiconductors ......See Entry 67061

62.00 MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER

(see also 46.30 Mechanics of solids and rheology, 61.70 Defects in crystals, 68.25 Surfaces and interfaces, 81. Materials science; for thermomechanical effects, see 65.70; for magnetomechanical effects, see 75.80; for piezoelectric effects, see 77.60; for elasto-optical effects, see 78.20H)

62.10 MECHANICAL PROPERTIES OF LIQUIDS

(for viscosity of liquids, see 66.20)

67083 Configurational compressibility of water. A.Srinivasa Rao (Dept. of Phys., Jawaharlal Inst. , Pondicherry, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.837-8 (Oct. 1982). [received: April 1983]
An expression for the configurational compressibility (β_c) has been obtained for water on the basis of broken hydrogen bond model. The derived formula for β_c shows that it depends on the applied pressure, temperature and the hydrogen bond energy of water. The theoretical values for β_c at 0°C and at normal atmospheric pressure comes out to be 55% of the experimental value for isothermal compressibility (β_T) of water. This compares favourably with the estimated value of 64% for the configurational contribution to β_T of pure water obtained from ultrasonic measurements in glycerol-water mixtures. The formula for β_c is valid up to pressures of 1500 kg/cm^2 and for temperatures below 30°C. (7 refs.)

A simple theory to predict small changes in volume and refractivity during mixing of a two-component liquid system ....See Entry 64636

Construction of lines of constant density and constant refractive index for ternary liquid mixtures ....See Entry 64637

Physicochemical properties, critical temperatures, and evaporation enthalpies of alkylalkoxysilanes and arylalkoxysilanes ....See Entry 67174

62.20 MECHANICAL PROPERTIES OF SOLIDS (RELATED TO MICROSCOPIC STRUCTURE)

(see also 81.40 Treatment of materials and its effects on microstructures and properties, 81.70 Materials testing)

67084 Influence of point defects due to nonstoichiometry on the densities of oxides. L.A.Krasikov, V.E.Shvaiko-Shvaikovskii (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.7, p.999-1002 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1184-8 (July 1982). [received: Feb. 1983]
The changes in density in oxides with various point defects are discussed in relation to the oxide content ΔX of the oxide. It is shown that, if the sign of the coefficient relating $\Delta\rho/\rho$ to ΔX is known and also the sign of X itself (i.e. in essence the sign of the exponent of pO_2), then the type of point defects can be assessed. (4 refs.)

67085 Random field of internal stresses from point defects in a crystal. A.S.Mel'nichenko (Inst. of Steel & Alloys, Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.717-20 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.43-7 (Aug. 1982). [received: April 1983]
The variance and correlation function are calculated for the internal stress field created by point defects situated independently at random lattice points in a crystal. For equal concentration dilatations, the amplitude of the internal stresses in a FCC lattice is several times the amplitude in a BCC lattice. It is shown that the stress field is practically uncorrelated and its probability density function is represented by an Edgeworth asymptotic series. An asymptotic representation of the stress distribution is proposed in the form of a superposition of a discrete stress spectrum and a normally distributed 'background.'. (11 refs.)

A structural interpretation of the density of alkali silicate glasses ....See Entry 66869

Effect of water content on properties of Na_2O3SiO_2 glasses ...See Entry 66889

Optical and other physical properties of $Al(PO_3)_3$-containing fluorophosphate glasses ....See Entry 68154

Properties of polycrystalline indium oxide in the air and in vacuum ....See Entry 68568

62.20D Elastic constants

(see also 03.40D Mathematical theory of elasticity, 81.40J Elasticity and anelasticity)

67086 Elastic moduli of a cracked body. L.G.Margolin (Los Alamos Sci. Lab., Univ. of California, Los Alamos, NM, USA).
Int. J. Fract. (Netherlands), vol.22, no.1, p.65-79 (May 1983).
Statistical solutions for the internal stress and displacement fields are constructed for a body in an external applied stress field, and containing a prescribed distribution of penny shaped cracks. From the fields, a stress-strain relationship is calculated for the body, and effective elastic moduli are derived. The fields are constructed as expansions in the parameter $N\bar{a}^3$ which is assumed small (N is the crack density, and a is the crack radius). Angular integrals over the distribution function are performed for two special cases that represent a bedded crack distribution, and an isotropic crack distribution. A criterion for the validity of the use of these quasistatic results in dynamical calculations is presented. (8 refs.)

67087 Thermal expansion coefficient and Young's modulus of hydrogenated FCC Fe-Ni Invar alloys. S.Harada (Faculty of Engng., Niigata Univ., Niigata, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1306-10 (April 1983).
Thermal expansion coefficient and Young's modulus of hydrogenated FCC Fe-Ni Invar alloys have been measured as a function of temperature and hydrogen concentration. Anomalous behaviour in thermal expansion and Young's modulus of the Invar alloys was faded with hydrogenation. This change corresponds to the disappearance of the characteristic weak ferromagnetic states of Fe-Ni Invar alloys, which was previously investigated by means of Mossbauer effect. The experimental results of thermal expansion, Young's modulus and Mossbauer effect were interpreted on the basis of the electron theory.

67088 Effective elastic properties of axial textures. Yu.V.Kuzmenko, V.I.Korneev, T.D.Shermergor (Inst. of Electronic Technol., Moscow, USSR).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.169-74 (April 1983).
A method for the determination of the effective elastic constants of polycrystals with texture was developed. The self-consistent approximation, energy and variational bounds were obtained on the basis of a singular approximation method of random functions. Numerical results were presented for the axial texture of polycrystalline copper. The calculations showed that the variational bounds are more restricting than the widely used energy bounds and lie within them. The self-consistent approximation always lies within the variational bounds. In the limiting cases of an isotropic polycrystal and exact orientation of crystallite axes along the axis of texture, the well-known results were obtained. (19 refs.)

67089 New third-order bounds on the effective moduli of N-phase composites. N.Phan-Thien (Univ. of Sydney, Sydney, Australia), G.W.Milton.
Q. Appl. Math. (USA), vol.41, no.1, p.59-74 (April 1983).
The authors develop some new bounds on the effective moduli of N-phase composites. These new bounds are accurate up to and including terms of third order in $O(|K_i\text{-}K_j|,\ |\mu_i\text{-}\mu_j|)$, where K_i and μ_i are the bulk and shear modulus, respectively, of phase i. These bounds use the same statistical information as J.J. McCoy's (1981) and M. Beran and J. Molyneux's (1965) bounds but are tighter than, or at worst coincident with, the latter bounds. A new perturbation solution is also presented for the effective moduli which only requires that $|\delta\mu|=O(|\mu_i\text{-}\mu_j|)$ be small. (21 refs.)

67090 Pressure variation of the elastic moduli of the sodium halides. S.Hart, P.H.Greenwood (Nat. Phys. Res. Lab., Pretoria, S Africa).
Solid State Commun. (USA), vol.46, no.2, p.161-4 (April 1983).
An ultrasonic study has been made of the variation of the elastic moduli of single crystals of the sodium halides to 1.5 GPa. A quadratic fit is required for the data. The systematics and in particular the second derivative of the bulk modulus has been found to be in general agreement with predictions of the Born model of the equation of state. (14 refs.)

67091 The temperature dependence of the elastic constants for highly oriented pyrolytic graphite determined by ultrasonic techniques. D.M.Hwang (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA).
Solid State Commun. (USA), vol.46, no.2, p.177-81 (April 1983).
Sound velocities along the c-axis of highly oriented pyrolytic graphite between 4 and 325K were measured with an ultrasonic pulse-echo phase-comparison

method. The echo delay times were determined with an accuracy of 0.05 and 0.15%, respectively, for the longitudinal and transverse modes. The temperature dependence of the *c*-axis elastic constants C_{33} and C_{44} was deduced with the correction of thermal expansion. C_{33} was found to decrease by 5.8% from 4 to 300K and can be interpreted by a model based on the simple Lennard-Jones interlayer interaction. C_{44} and its temperature variation are found to be strongly sample dependent. (20 refs.)

67092 Temperature derivatives at constant volume of the elastic constants of alkali halide crystals. J.Shanker (Dept. of Phys., Agra Coll., Agra, India), R.K.Varshney.
Solid State Commun. (USA), vol.46, no.3, p.263-4 (April 1983).
A new method has been developed for calculating the temperature derivatives at constant volume of the elastic constants of the alkali halides using the concept of phonon pressure. Calculated values of temperature derivatives of elastic constants are compared with the corresponding values recently derived from ultrasonic experimental data. (6 refs.)

67093 Pressure dependence of elastic constants of orthorhombic $Li_2Ge_7O_{15}$ above and below the ferroelectric transition. S.Haussuhl (Inst. fur Kristallographie, Univ. zu Koln, Koln, Germany).
Solid State Commun. (USA), vol.46, no.5, p.423-6 (May 1983).
The pressure derivatives of the elastic constants c_{ij} of orthorhombic $Li_2Ge_7O_{15}$ have been determined at 293K by the method of pressure-induced shifts of resonance frequencies of thick plates at ca. 15 MHz in the range between 0 and 1500 bar. Approaching the transition at ca. 630 bar, all $P_{ij}=dc_{ij}/dp(i, j=1,2,3;p$ pressure) develop strongly negative values. At higher pressures a similar behaviour with reversed sign is observed. The pressure derivatives of the pure 'shear resistances' c_{44}, c_{55}, and c_{66} depend only slightly on pressure even in the vicinity of the transition. The main interactions driving the transiton are of the totally symmetric type. The values dK^{-1}/dp (K volume compressibility) deviate strongly from the quasi-invariant value of ca. 5 observed in almost all stable crystals ($dK^{-1}/dp=-1750$ at 620 bar and 1380 at 700 bar). The anomalous piezoelastic behaviour reflects the anomalous thermoelastic behaviour: negative P_{ij} in the low pressure (high temperature) phase correspond to positive T_{ij}-d log c_{ij}/dT (T temperature) and vice versa. (12 refs.)

Averaged equations of the theory of elasticity of matrix composites .... See Entry 66469

Epon 828 epoxy: a new photoelastic-model material .... See Entry 66530

Study of the structural evolution in metallic glass $Fe_{83}B_{14}Si_{1.5}C_{1.5}$ by measuring internal friction and Young's modulus .... See Entry 66890

Static and structural properties of III-V zincblende semiconductors .... See Entry 66967

Radiation-induced crystallinity changes in linear polyethylene .... See Entry 67049

Amplitude-dependent ultrasound absorption and acoustoplastic effect during active deformation of sodium chloride crystals .... See Entry 67107

Acoustic symmetry and the third order elastic constants of tetragonal TII (4/m) crystals .... See Entry 67114

Elastic anomaly near zero-gap state in narrow-gap semiconductors .... See Entry 67116

Elastic anisotropy and phonon dispersion effects in iron and tungsten .... See Entry 67131

Lattice dynamical calculation of the phonon dispersion in sodium halide crystals .... See Entry 67132

Estimation of the Debye temperature of diamond-like semiconducting compounds from bulk moduli and microhardness .... See Entry 67149

Low temperature structural and magnetic properties of $PrPb_3$ .... See Entry 67189

Static properties of $CsliSO_4$ near the ferroelastic phase transition .... See Entry 67200

Study about the onset of intermediate valency in $TmSe_{0.32}Te_{0.68}$ under pressure .... See Entry 67454

Optical and other physical properties of $Al(PO_3)_3$-containing fluorophosphate glasses .... See Entry 68154

Acoustooptic parameters of calcium molybdate crystals .... See Entry 68173

Brillouin spectroscopy in $K_2Ba(NO_2)_4$ .... See Entry 68251

Influence of elastic stress on the formation of cubic and axial $\{hk0\}\langle 001\rangle$ texture in 3% ferrosilicon .... See Entry 68555

Temperature dependence of dynamic & static Young's modulus of polymers .... See Entry 68575

The mechanical moduli of lamellar semicrystalline polymers .... See Entry 68576

The influence of low-temperature crystallisation on the tensile elastic modulus of natural rubber .... See Entry 68577

Properties of stresses in composites with ribbon-like inclusions .... See Entry 68581

Mechanical properties of Cu-based composites with in situ formed ultrafine filaments .... See Entry 68584

On some micromechanism of memory of metals in the case of nonstationary processes of deformation in the thermal activation range .... See Entry 68585

62.20F Deformation and plasticity

(inc. yield, ductility and superplasticity; see also 81.40L Deformation, plasticity and creep)

67094 Effective compressibilities of some ionic semi-conducting compounds of IV-VI group. B.R.K.Gupta, S.Singh (Dept. of Phys., G.B. Pant Univ. of Agriculture & Technol., Pantnagar, India).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.455-61 (1983).
An analysis of effective compressibilities of the ionic semiconductors PbS, PbSe, PbTe and SnTe has been performed within the framework of many body lattice theory (MLT). The extended three body force shell model (ETSM) which is ultimately based on MLT has been employed to evaluate the values of effective compressibilities of the solids under study. The model parameters have been calculated by using the expressions of elastic, optical and dielectric constants within the framework of the theory described in ETSM. The values of elastic constants and long wave optical vibration frequency have been used in the expressions as input data. The analysed values of β^*/β are in close agreement with the results obtained from the Szigeti relation. (16 refs.)

67095 Anisotropic yield surfaces in cyclic plasticity. S.J.Harvey, P.Adkin (Lanchester Polytech., Coventry, England), P.J.Jeans.
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.89-99 (1983).
An anisotropic form of the Von Mises yield criteria is presented which includes linear terms and therefore enables Bauschinger effects to be considered when constructing yield or loading surfaces. The coefficients representing the state of anisotropy are expressed in terms of the uni-axial and shear yield stress of the material. It is suggested that this form of the yield or loading surface can be used to determine the plastic strains for a range of multi-axial and cyclic plasticity problems and results are presented for the particular case of a tube subjected to cyclic plastic torsion with an axial stress. (17 refs.)

67096 Yield point and dislocation mobility in silicon and germanium. W.Schroter (Phys., Inst., Univ. Gottingen, Gottingen, Germany), H.G.Brion, H.Siethoff.
J. Appl. Phys. (USA), vol.54, no.4, p.1816-20 (April 1983).
Measurements of the lower yield point in silicon and germanium, covering wide ranges of temperature and strain rate, are presented. The results indicate that Haasen's model for the beginning of the plastic deformation of semiconductors has to be modified for germanium, while it is confirmed for silicon. (27 refs.)

67097 Kinetics of strain-induced reorientation of zinc-sulfide and zinc-selenide crystal structures. S.A.Omel'chenko, S.I.Bredikhin, P.A.Berlov, M.F.Bulanyi, S.Z.Shmurak, A.Ya.Yakunin (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1586-9 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2803-8 (Sept. 1982). [received: April 1983]
The effect of plastic deformation of zinc-sulfide and zinc-selenide crystals on their crystal structure and on the symmetry of Mn^{+2} impurity centers is investigated. It is shown that the plastic deformation and the structural reorientation of the ZnS crystals result exclusively from the motion of partial dislocations; the kinetics of this process is investigated. A similar structure reorientation was observed in twinning ZnSe crystals. The contribution of the partial and regular dislocations to the plastic deformation of ZnSe crystals is determined. (9 refs.)

67098 Peculiarities of the plastic deformation of crystals with a curved lattice. B.I.Smirnov, V.I.Nikolaev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1724-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3045-50 (Oct. 1982). [received: April 1983]
Experiments were conducted to study the characteristics of plasticity and the evolution of the dislocation structure produced by single slip in LiF crystals having a curved lattice. Specimens with such a lattice were predeformed by bending or torsion. An increase in the angle of bending or torsion was shown to lead to a strong increase in the work-hardening coefficient. The length of the plateau of flowability and the density of edge components of the dislocations are practically independent of this angle. The change in the nature of hardening in crystals with a curved lattice was explained by the fact that slip in these crystals is geometrically nonlinear (the slip 'planes' transform into surfaces) and a large number of steps of like sign may occur in the dislocations. (9 refs.)

67099 Motive forces of plastic deformation and rotations in crystals with internal boundaries. A.E.Volkov, V.A.Likhachev, P.I.Nikolaev (A.A. Zhdanov Leningrad State Univ., Leningrad, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.737-40 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.65-8 (Aug. 1982). [received: April 1983]
The forces acting on the internal boundaries from the homogeneous and inhomogeneous components of the stress field are calculated. An interpretation of the torque stress is given, within the framework of theories using symmetric stress in media with an inhomogeneous structure. The reasons for the appearance of plastic deformations and rotations in the crystal are discussed. (7 refs.)

Numerical treatment of the cladding mechanics in the fuel rod computer code IAMBUS .... See Entry 65311

Plastic bend in a growing crystal .... See Entry 66905

Powder neutron diffraction study of nickel-titanium martensite .... See Entry 66936

Influence of the medium on the distribution of dislocations near a surface parallel to the Burgers vector in deformed LiF crystals .... See Entry 67003

Modelling intrinsic stresses by setting up Somigliana dislocations .... See Entry 67005

Effect of phosphorus doping on stress in silicon and polycrystalline silicon .... See Entry 67025

Analysis of thermal stresses induced in silicon during xenon arc lamp flash annealing .... See Entry 67035

Radiation-induced crystallinity changes in linear polyethylene .... See Entry 67049

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep .... See Entry 67100

Amplitude-dependent ultrasound absorption and acoustoplastic effect during active deformation of sodium chloride crystals .... See Entry 67107

Static properties of $CsliSO_4$ near the ferroelastic phase transition .... See Entry 67200

The surface energy of zinc .... See Entry 67339

Influence of the normal phase concentration and morphology on the superconductor flow stress .... See Entry 67844

Brillouin spectroscopy in $K_2Ba(NO_2)_4$ .... See Entry 68251

Mechanical and superconducting properties of $Cu-Nb_3Sn$ in situ produced composite wires .... See Entry 68480

Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state .... See Entry 68526

Influence of small deformations on the stability of fine-grain structure in the alloy Fe-3% Si .... See Entry 68557

A theory of non-linear anisotropic hardening .... See Entry 68559

An X-ray diffraction study of lattice imperfection in cold-worked FCC alloys. IV. Copper-germanium (alpha-phase) .... See Entry 68560

The work-hardening behaviour of hydrogen-charged high purity iron single crystals at temperatures between 296 and 200K .... See Entry 68562

Work hardening and dynamical recovery in silicon and germanium at high temperatures and comparison with FCC metals .... See Entry 68563

Hot rolling of Sendust .... See Entry 68569

Effect of composition on deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust ....See Entry 68570

The high temperature degradation of Cd-Zn and Pb-Cd eutectic alloys ....See Entry 68572

Mechanical properties of Cu-based composites with in situ formed ultrafine filaments ....See Entry 68584

On some micromechanism of memory of metals in the case of nonstationary processes of deformation in the thermal activation range ....See Entry 68585

On a model for the study of redistribution of residual microstresses during complex loading of polycrystalline metals ....See Entry 68586

Stabilization of copper alloys by heat treatment ....See Entry 68587

Alterations in the microstructure of 304 stainless steel produced by small strain deformation at ambient temperature ....See Entry 68588

Superplasticity: a review of data ....See Entry 68589

Necking and deformation behavior of locally annealed aluminum sheets in simple tension ....See Entry 68590

Microplasticity and strength of Mn-Zn ferrites ....See Entry 68596

Temperature dependence of $\{11\bar{2}2\}\langle\bar{1}\bar{1}23\rangle$ slip in zinc ....See Entry 68597

Deformation in 30% cold-rolled Cu-30Zn brass grains ....See Entry 68598

On the adiabatic shear of Ti-6Al-4V ballistic targets ....See Entry 68599

Strain-temperature correlations obtained in rolling ....See Entry 68600

Substructure and back stress changes resulting from the cyclic loading of $2^1/_4$Cr-1Mo steel at 755K ....See Entry 68601

Influence of temperature and stretching rate on the strength of polyester fibres of small elongation ....See Entry 68602

On dilatation and plastic flow in metallic glasses ....See Entry 68603

Bauschinger effect in a dual-phase steel ....See Entry 68605

Shape memory effect in the vanadium-hydrogen system ....See Entry 68606

Concentrational and temperature dependence of the physical yield point of FCC polycrystals of copper solid solutions ....See Entry 68607

Consideration of anisotropy parameters in polycrystalline metals ....See Entry 68608

Transverse mechanical behavior of high-strength monocarbide eutectics ....See Entry 68609

The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys ....See Entry 68610

Off-axis tensile properties of γ/γ'-αMo DS eutectic ....See Entry 68611

Tensile creep and relaxation of the lamellar Al-Al_2Cu composite. Experiments on the tensile stage of a high voltage transmission electron microscope (HV TEM) ....See Entry 68612

Influence of an overload on the fatigue crack growth in steels ....See Entry 68618

On the relation between stable crack growth and fatigue ....See Entry 68620

On life time predictions with the strain range partitioning method ....See Entry 68623

Brittleness of Sendust ....See Entry 68627

Plasticity and fracture of inorganic glasses at high speed grinding ....See Entry 68636

Fracture surfaces and mechanical properties of tungsten heavy metals ....See Entry 68645

Effects of cold rolling and annealing on the mechanical properties of 90W-7Ni-3Fe heavy alloys ....See Entry 68654

Correlation of erosion with mechanical properties in metals ....See Entry 68668

Depassivation of iron by straining and by abrasion: an a.c. impedance study ....See Entry 68685

Carburizing of dual-phase steel ....See Entry 68693

A statistical method of determining the early signs of necking ....See Entry 68715

Comments on: deformation twins in punched specimens of a 321 steel ....See Entry 68739

Deformation in punched specimens of type 304 stainless steel ....See Entry 68740

Cold stamping by extrusion ....See Entry 68752

62.20H Creep

(see also 81.40L Deformation, plasticity and creep)

67100 Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep. A.A.Rubinstein (Dept. of Mech. Engng., State Univ. of New York, Stony Brook, NY, USA).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.593-616 (1983).
Deals with certain aspects of elevated temperatures creep cavitation of grain boundaries under cyclic and rapidly applied loading. The response of partially damaged materials (where damage is represented as crack-like cavities on the grain boundaries) following load alterations at temperatures in the vicinity of 0.5 T_m or higher is analyzed. The interaction between grain boundary diffusion and elastic deformation is important in alleviating local stress concentrations under these conditions. The stress levels considered are assumed to be low enough that plastic deformation is significant. Diffusive processes contribute to high temperature creep rupture by material redistribution from the void surfaces to the grain boundaries, and any non-uniform matter accommodation along the grain boundaries is accomplished by elastic deformation under the conditions assumed. The same material redistribution mechanism dominates in the stress relaxation process. The analysis of the stress and displacement fields is based on consideration of the coupled elasticity-diffusion boundary value problem, which leads to an integral equation. On the basis of the solution obtained, the detailed analysis of the process under cyclic, step and ramp loadings is given. (14 refs.)

67101 Pure diffusional creep of NiO polycrystals. M.Jimenez-Melendo, J.Cabrera-Cano, A.Dominguez-Rodriguez, J.Castaing (Dept. de Optica, Univ. de Sevilla, Seville, Spain).
J. Phys. Lett. (France), vol.44, no.9, p.L339-43 (1 May 1983).
Compressive creep testing of polycrystalline NiO has been performed in air and argon, at temperatures between 1100 and 1500°C (0.61 to 0.79 T_M) under loads corresponding to initial applied stresses from 6 to 90 MPa. Nabarro creep was observed in the lower stress range; creep rate and oxygen diffusivity show a good correlation. (9 refs.)

Numerical treatment of the cladding mechanics in the fuel rod computer code IAMBUS ....See Entry 65311

Irradiation creep in the fusion reactor first wall ....See Entry 65666

A mechanism of void growth in the region of the plastic zone ahead of a crack-tip ....See Entry 66979

The influence of alloy chemistry on controlling fiber volume fraction in Ni-base MC aligned eutectics ....See Entry 68509

Uniaxial stress relaxation and creep behaviour in weldments of the pressure vessel steel A533B between 600 and 640°C ....See Entry 68574

Effect of the type of pre-torsional deformation on the creep rate of a silver-copper alloy ....See Entry 68591

The effect of molybdenum in Type 316 stainless steel on grain boundary self-diffusion and creep rate at low stresses ....See Entry 68592

Effect of ion implantation on creep of molybdenum ....See Entry 68595

The influence of trace additions of zirconium on diffusional creep in Ni-20% Cr ....See Entry 68604

Tensile creep and relaxation of the lamellar Al-Al_2Cu composite. Experiments on the tensile stage of a high voltage transmission electron microscope (HV TEM) ....See Entry 68612

A correlation law for steady state creep and stress relaxation tests on the Al-Al_2Cu composite ....See Entry 68613

62.20M Fatigue, brittleness, fracture, and cracks

(inc. hardness; see also 81.40N Fatigue, embrittlement and fracture)

67102 Cracking due to a plate-form inclusion of shear type. Zhie Xiao-Li, Zhang Hong-Tu (Dept. of Phys., Lanzhou Univ., China).
Acta Phys. Sin. (China), vol.32, no.2, p.182-90 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Plate-form inclusions of shear type represent the mechanical aspect of many important processes, such as the formation of slip bands, twin bands and martensite plates in crystalline materials. All these processes connect closely with fracture of materials. Analytical expressions for stress intensity fators of the crack near the inclusion have been derived by using dislocation theoretical method. Using the results of this paper, some aspects of the cracking due to a plate-form inclusion are discussed. The Hall-Petch relation of twin-fracture stresses can be obtained from the inclusion/ model, and the theoretical results are in good agreement with experiments. (15 refs.)

67103 Fracture of glass, brittle fracture. D.Francois (CNRS, Univ. de Technol. de Compiegne, Compiegne, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.571-80 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Linear elastic fracture mechanics derives from the Griffith's theory of fracture. The state of stress at the tip of a crack is characterized by a single parameter, the stress intensity factor K, which in turn is related to the strain energy release rate G. The fracture energy must be correlated with the structure of the crack tip, yet poorly known. (30 refs.)

67104 Tetragonal distortion and drift flow of solute atoms near a crack tip. Y.T.Chou, M.Gao, M.Lu, R.P.Wei (Dept. of Metall. & Materials Engng., Lehigh Univ., Bethlehem, PA, USA).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.245-55 (April 1983).
The drift flow of solute atoms near the crack tip in a cubic crystal, subjected to mode I, mode II and mode III loading, is analyzed for the case where lattice distortion by the solutes is tetragonal. The results show that the flow pattern is complex and is dependent on the orientation of the crack plane and of the crack front in the crystal. Detailed data for cracks oriented parallel to the (010) and $(1\bar{1}0)$ planes, with the crack front lying along selected directions, are given. Unlike the case of spherical distortion, the drift flow of solutes can occur under mode III loading, except for a few special orientations, in addition to under mode I and II loading. The 'saturation concentration' of solutes near the crack tip also varies with the mode of loading and the orientation of the crack. These results suggest that the potential for hydrogen embrittlement exists under all three modes of loading, in contradistinction to an earlier finding based on considerations of spherical distortion. (23 refs.)

67105 Semiempirical, quantum mechanical calculation of hydrogen embrittlement in metals. M.S.Daw, M.I.Baskes (Sandia Nat. Lab., Livermore, CA, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1285-8 (25 April 1983).
A new, semiempirical model of metals and impurities (embedded atom method) makes possible a static treatment of the brittle fracture of a transition metal in the presence of hydrogen. Results indicate that hydrogen can reduce the fracture stress in nickel. (20 refs.)

The effect of composition and radiation on the fracture of a nuclear waste glass ....See Entry 65338

Alpha decay self-damage in cubic and monoclinic zirconolite ....See Entry 65401

Axisymmetric problem of a flat interface annular crack between an elastic layer and a half-space ....See Entry 66509

Internal energy dissipation in metals subjected to cyclic stresses with varying amplitudes ....See Entry 66513

Nature of substructural hardening ....See Entry 66526

Transient response of a central crack to a tensile pulse ....See Entry 66536

Short range structure and some physical properties of the glasses in the system Na_2O-Ga_2O_3-SiO_2 ....See Entry 66871

A mechanism of void growth in the region of the plastic zone ahead of a crack-tip ....See Entry 66979

Elastic moduli of a cracked body ....See Entry 67086

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep ....See Entry 67100

Estimation of the Debye temperature of diamond-like semiconducting compounds from bulk moduli and microhardness ....See Entry 67149

The surface energy of zinc ....See Entry 67339

Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$ ....See Entry 68433

Growth and thermal stability of γ/γ'-α eutectic composite ....See Entry 68477

Sintering of partially stabilized zirconia ....See Entry 68491

Sintering of calciumphosphate ceramics for biomedical purposes ....See Entry 68492

Influence of sintering temperature of WMn layer on structure and strength properties of ceramic-to-metal seals .... See Entry 68494

Section of the phase diagram of the In_2Te_3-Fe system in the vicinity of In_2Te_3 and thermodynamic investigation of nonionized impurity atoms in crystals with stoichiometric vacancies .... See Entry 68519

Stress-induced transformations in composite zirconia ceramics .... See Entry 68539

Thermal effect of nitrogen implantation on high carbon steels .... See Entry 68549

The work-hardening behaviour of hydrogen-charged high purity iron single crystals at temperatures between 296 and 200K .... See Entry 68562

On the influence of impurity additions and quenching temperature on the course of the microhardness (HV) during a two-step ageing treatment of an Al-2.0 at.% Zn-1.3 at.% Mg alloy .... See Entry 68567

Necking and deformation behavior of locally annealed aluminum sheets in simple tension .... See Entry 68590

Transverse mechanical behavior of high-strength monocarbide eutectics .... See Entry 68609

Off-axis tensile properties of γ/γ'-αMo DS eutectic .... See Entry 68611

Observations of cyclic grain boundaries migration in aluminium after large numbers of fatigue cycles .... See Entry 68614

Non-conventional tungsten-base hard metal .... See Entry 68615

Fracture toughness of hardened cement paste and concrete .... See Entry 68616

Assessment of the susceptibility to hydrogen embrittlement with an original specimen. I. Effect of heat treatment on delayed failure time of 38 NiCrMo 4 steel .... See Entry 68617

Influence of an overload on the fatigue crack growth in steels .... See Entry 68618

The effect of environment on the growth of small fatigue cracks .... See Entry 68619

On the relation between stable crack growth and fatigue .... See Entry 68620

Slow fatigue crack growth and threshold behaviour in IMI 685 .... See Entry 68621

A study of short fatigue crack growth behaviour in titanium alloy IMI 685 .... See Entry 68622

On life time predictions with the strain range partitioning method .... See Entry 68623

The selection of crack path on fatigue crack propagation in dual phase steels .... See Entry 68624

Hydrogen embrittlement of yttrium .... See Entry 68625

Intergranular fracture of high purity iron due to oxygen .... See Entry 68626

Brittleness of Sendust .... See Entry 68627

The influences of heat-treatment and cold-work on the low temperature hydrogen embrittlement of austenitic stainless steels .... See Entry 68628

The Bainite transformation and fracture mode of Fe-C-Mn high strength steel containing high carbon .... See Entry 68629

About embrittlement process in amorphous metals .... See Entry 68630

Viscous failure of glass at high shear rates .... See Entry 68631

Strength of chalcogenide glasses of the system Se-Ge-As .... See Entry 68632

Tensile strength characteristics of 'perfect' silica fibers .... See Entry 68633

Strength of optical fibres under combined stresses and aging in various environments .... See Entry 68634

Dynamic fracture in borosilicate glasses .... See Entry 68635

Plasticity and fracture of inorganic glasses at high speed grinding .... See Entry 68636

Dynamic fatigue of sodium-silicate glasses with high water content .... See Entry 68637

Concentration fluctuations as sources of internal stresses in metallic glasses .... See Entry 68639

Low temperature fatigue fracture of metals and alloys .... See Entry 68640

On the dependence of fracture toughness on metallurgical factors .... See Entry 68641

Analytical description of ageing of polyamide 6 subjected to fatigue failure .... See Entry 68642

Theoretical fatigue life of helically stranded optical fibres .... See Entry 68643

Fracture surfaces and mechanical properties of tungsten heavy metals .... See Entry 68645

Strain localization during fatigue of precipitation-hardened aluminium alloys .... See Entry 68646

Arsenic and platinum deposition during cathodic hydrogenation .... See Entry 68647

Precipitation induced embrittlement after thermal exposure of high-manganese, austenitic retaining-ring steels .... See Entry 68648

Crack-tip heating in steel during cyclic loading .... See Entry 68649

On the existence of hydrostatic stress fields for mode II hydrogen embrittlement .... See Entry 68650

Influence of the breakdown mechanism on the behavior of lead-antimony alloys with an alternating load .... See Entry 68651

The influence of structure parameters on strength and fracture toughness of brittle covalent crystals and corresponding sintered materials .... See Entry 68652

The influence of titanium carbide and bonding phase composition on the properties of titanium carbide-steel cermets .... See Entry 68653

Effects of cold rolling and annealing on the mechanical properties of 90W-7Ni-3Fe heavy alloys .... See Entry 68654

Mechanical behaviour of eutectic superalloys .... See Entry 68655

The low cycle fatigue behavior of three advanced nickel-base eutectic composites .... See Entry 68656

Fatigue crack growth in Co and Ni base directionally solidified eutectic composites .... See Entry 68657

The role of solidification rate on fiber distribution and mechanical properties of a directionally solidified nickel base-TaC eutectic .... See Entry 68658

Off-axis mechanical properties of a cellular Al-Al_3Ni directionally solidified eutectic .... See Entry 68659

The influence of hardness on the resistance to wear by paper .... See Entry 68664

Structural characterization of laser-processed molybdenum steel .... See Entry 68694

62.20P Tribology

(see also 81.40P Friction, lubrication and wear)

67106 Mechanical and physical properties of amorphous solids based on $(CH_3)_2SiO$-SiO_2 gels. H.Schmidt, A.Kaiser, H.Patzelt, H.Scholze (Fraunhofer-Inst. fur Silicatforschung, Wurzburg, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.275-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The influences of reaction conditions and compositions on the physical properties of gels in the system $(CH_3)_2SiO$-SiO_2 were investigated. These materials are prepared by cohydrolysis and cocondensation of $(CH_3)_2Si(OEt)_4$ and were developed for being used as abrasive powders with limited effectiveness. They are applied for cosmetical or medical purposes, e.g. smoothening the human skin. Hydrolysis and condensation are monitored by IR, NIR and MS methods for characterization of the materials SEM, SAXS, BET surface measurement, and a special abrasive test were used. (5 refs.)

Characterization by X-ray topography of subsurface deformation in abrasive wear .... See Entry 67334

Possibilities and limitations for the application of CVD-coated cemented carbide tools and steel tools .... See Entry 68452

Wear-resistant cobalt-base alloys .... See Entry 68660

A study of cavitation erosion of cast iron .... See Entry 68661

The effect of carbide volume fraction on the low stress abrasion resistance of high Cr-Mo white cast irons .... See Entry 68662

A study of abrasive wear mechanisms in cobalt-base alloys .... See Entry 68663

The influence of hardness on the resistance to wear by paper .... See Entry 68664

The processes accompanying metal wear in polymer-containing abrasive media .... See Entry 68665

Wear of aluminium under dry sliding conditions .... See Entry 68666

The erosion rate of reaction-bonded SiC containing various amounts of free silicon .... See Entry 68667

Correlation of erosion with mechanical properties in metals .... See Entry 68668

Depassivation of iron by straining and by abrasion: an a.c. impedance study .... See Entry 68685

Conforma Clad—a new process for customized coatings .... See Entry 68687

Carbide-dispersion carburizing of vanadium steels .... See Entry 68692

62.30 MECHANICAL AND ELASTIC WAVES

(see also 03.40K Mathematical aspects)

Ferroelectric phase transitions in $CsLiWO_4$ .... See Entry 68135

62.40 ANELASTICITY, INTERNAL FRICTION, AND DAMPING

(see also 81.40J Elasticity and anelasticity)

67107 Amplitude-dependent ultrasound absorption and acoustoplastic effect during active deformation of sodium chloride crystals. A.B.Lebedev, S.B.Kustov, B.K.Kardashev.
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1798-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3169-71 (Oct. 1982). [received: April 1983]
The authors have simultaneously measured the internal friction, the elastic modulus defect, and the acoustoplastic effect as functions of the amplitude of ultrasonic vibrations at individual points of the deformation diagram during plastic bending of specimens of single-crystal sodium chloride. The ultrasonic vibrations were excited and the internal friction was measured by using the resonance method of a three-component piezoelectric vibrator in a self-excited circuit. (11 refs.)

Study of the structural evolution in metallic glass $Fe_{83}B_{14}Si_{1.5}C_{1.5}$ by measuring internal friction and Young's modulus .... See Entry 66890

Hydrogen motion in single-crystal palladium hydride as studied ultrasonically .... See Entry 67117

Effect of relaxation of transformation stresses on the martensite points .... See Entry 68543

Uniaxial stress relaxation and creep behaviour in weldments of the pressure vessel steel A533B between 600 and 640°C .... See Entry 68574

Ionomeric blends. II. Compatibility and dynamic mechanical properties of sulfonated, cis-1,4-polyisoprenes and styrene/4-vinylpyridine copolymer blends .... See Entry 68578

Physical aging of glasses .... See Entry 68580

Study of internal friction at high temperatures of high purity polycrystals and single crystals of nickel .... See Entry 68582

Some distinctive features of amplitude-dependent internal friction .... See Entry 68583

Tensile creep and relaxation of the lamellar Al-Al_2Cu composite. Experiments on the tensile stage of a high voltage transmission electron microscope (HV TEM) .... See Entry 68612

A correlation law for steady state creep and stress relaxation tests on the Al-Al_2Cu composite .... See Entry 68613

Dynamic fatigue of sodium-silicate glasses with high water content .... See Entry 68637

62.50 HIGH-PRESSURE AND SHOCK-WAVE EFFECTS IN SOLIDS

Pressure necessary for polymorphic transitions in pyrochlore structures .... See Entry 66921

Structure of 'Orange' $^{18}O_2$ at 9.6 GPa and 297K .... See Entry 66927

X-ray diffraction data from the high pressure phase of AlSb .... See Entry 66954

Pressure variation of the elastic moduli of the sodium halides .... See Entry 67090

Pressure dependence of the optical phonon in solid hydrogen and deuterium up to 230 kbar .... See Entry 67142

An X-ray diffraction study of lattice compression and phase transition of crystalline phosphorus .... See Entry 67188

Pressure-induced disproportionation in CuBr .... See Entry 67192

Energy gap dependance of the acceptor ionization energy induced by hydrostatic pressure at low temperature, near the SM-SC transition on $Hg_{1-x}Cd_xTe$ .... See Entry 67443

Substitution of TMTSeF with TMTTF in $(TMTSeF)_2ClO_4$: high pressure studies .... See Entry 67450

Impurity states in n-type $Hg_{1-x}Cd_xTe$ in high magnetic field and under hydrostatic pressure .... See Entry 67526

Effects of high pressure-high temperature treatment on the structure composition and superconductivity of $Nb_3(Al,Ge)$ .... See Entry 67829

Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine .... See Entry 68198

Study on the dependence of donor-acceptor luminescence of $(Zn_{0.85}Cd_{0.15})S$: Cu, Al phosphor on hydrostatic pressure using high-pressure microspectroscopic system .... See Entry 68287

The *P-T* phase diagram of lithium iodate ($LiIO_3$) up to 40 kbars .... See Entry 68512

62.60 ACOUSTIC PROPERTIES OF LIQUIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for second sound in quantum fluids, see 67.40, 67.50 and 67.60)

67108 Speed of sound in superheated organic liquids. R.G.Ismagilov, G.V.Ermakov (Physicotech. Problems in Power Engng., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.561-6 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.677-82 (July-Aug. 1982). [received: April 1983]
A pulse technique at a frequency of 2.5 MHz is used to measure the speed of sound in n-pentane, n-hexane, n-heptane, benzene, acetone, and ether in the temperature internal 100-200°C with transition into the region of metastable states up to 10 atm. It is noted that the speed-of-sound isotherms are continuous in transition across the saturation line. (8 refs.)

67109 Ultrasonic investigation of interactions in mercury. S.Singh Bhatti (Dept. of Phys., Guru Nanak Dev Univ., Amritsar, India), D.P.Singh.
Indian J. Pure & Appl. Phys., vol.20, no.12, p.961-4 (Dec. 1982). [received: April 1983]
Ultrasonic velocities are computed at 12 temperatures and the applicability of some liquid state models to mercury is tested. Jacobson's free length theory (1952) and Schaaff's collision factor theory (1963) as also the relation between sound velocity and latent heat (suggested by Ramachandra Rao and Padmini (1960)) hold fairly well. However, the hard sphere model with attractive interactions holds only partially as the molecules do not have symmetry properties. (24 refs.)

67110 Ultrasonic wave propagation and its relation to molecular relaxation times in some organic liquids. A.V.Narasimham (Dept. of Phys., Indian Inst. of Technol., Madras, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.790-5 (Oct. 1982). [received: April 1983]
Various methods have been proposed and discussed for the determination of the intermolecular relaxation times (pertinent to the highly viscous and associated liquids, in which the structural relaxation dominates) and the intramolecular relaxation times (pertinent to the nonviscous and nonassociated liquids, in which the vibrational relaxation dominates), in terms of the compressibility and bulk viscosity of these liquids and also absorption and dispersion of ultrasonic waves. A relation has been obtained between the intramolecular and intermolecular relaxation times of some organic liquids. The vibrational relaxation time is found to be always greater than the structural relaxation time. The variations of ultrasonic velocity and absorption coefficient with frequency and their values at very low and very high frequencies have been discussed. It is observed that the dispersion of the wave. Approximate calculations indicate that the expressions are fairly valid. (15 refs.)

67111 Temperature dependence of the sound velocity and ultrasonic attenuation in liquid Bi-Ga and Bi-Sn alloys. M.Rosen (Center for Materials Res., Johns Hopkins Univ., Baltimore, MD, USA), Z.Salton.
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.189-94 (April 1983).
The temperature dependence of the sound velocity and ultrasonic attenuation in several liquid Bi-Ga and Bi-Sn alloys was determined by means of an ultrasonic pulse technique. The sound velocity is shown to be linear with temperature and parabolic with concentration in Bi-Sn alloys, and in Bi-Ga alloys in the miscibility region. This behavior indicates a correlation between the behavior of the electrical resistivity and of the sound velocity. A rapid gravitational separation was observed at 262°C for the critical composition in the Bi-43.77 wt.%Ga alloy. Ultrasonic attenuation measurements permitted the accurate determination of the position of the interface (meniscus) between the separated liquid phases. The rate of motion of the meniscus as a function of temperature and composition was measured. The ultrasonic technique is shown to be useful for the accurate determination of phase diagram boundaries in systems with a liquid miscibility gap. (12 refs.)

67112 Ultrasound absorption in polystyrene solutions near the miscibility coexistence curve and critical point. D.B.Fenner (Dept. of Phys., Univ. of Santa Clara, Santa Clara, USA).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.444-6 (4 April 1983).
Ultrasound absorption is reported for solutions of a monodisperse polystyrene. These solutions were studied above the miscibility coexistence curve, for concentrations near and above the critical value. An excess absorption of the Kawasaki-type multiple relaxation was observed. The absorption exhibited a phase-separation, but not a critical-point, anomaly. (10 refs.)

Acoustic relaxation in a mixture having a lower critical solution point .... See Entry 67122

62.65 ACOUSTIC PROPERTIES OF SOLIDS

(see also 62.80 Ultrasonic relaxation; for sound propagation, see 43.; for lattice dynamics and phonons, see 63.; for magnetoacoustic effects, see 72.55; for acoustoelectric effects, see 72.50; for acousto-optical effects, see 78.20H)

67113 Temperature dependence of hypersonic attenuation in NaCl and KCl crystals. J.-P.Bonnet, M.Boissier, C.Vedel, R.Vacher (Lab. de Spectrometrie Rayleigh-Brillouin, Univ. des Sci. & Tech. du Languedoc, Montpellier, France).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.515-19 (1983).
The usual theories of ultrasonic attenuation (Landau-Rumer and Akhiezer) are in disagreement with experiments involving hypersonic phonons (Brillouin scattering). This is shown here by measurements on NaCl and KCl. The authors observe a T^n dependence with n approximately equal to 2.8, and an attenuation increasing with temperature in the low and high temperature range respectively. An extension of the Landau-Rumer and Akhiezer theories to hypersonic frequencies is proposed. The theoretical expressions give a good account of the temperature dependence of the attenuation in the whole temperature range. (18 refs.)

67114 Acoustic symmetry and the third order elastic constants of tetragonal TII (4/m) crystals. P.Blanchfield, A.J.Miller, G.A.Saunders (School of Phys., Univ. of Bath, Bath, England).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.569-77 (1983).
The mode equations which relate the measured hydrostatic and uniaxial pressure derivatives of the 'natural' ultrasonic velocity to the second and third order elastic constants for the tetragonal TII ($4/m$) Laue group have been transformed from the crystallographic (XYZ) axial frame to a reference frame (κ, $\kappa+\pi/2$, Z) comprised of two acoustic symmetry axes and the fourfold axis. It is found that, if the acoustic symmetry axes do not shift appreciably with pressure, the mode equations for TII crystals in this reference frame are much simpler than those in the crystallographic axial frame (XYZ), having the same form as those for the higher symmetry TI Laue group. Hence 12 transformed third order elastic constants can be obtained experimentally for TII crystals by making measurements of the hydrostatic and uniaxial pressure derivatives of ultrasonic wave velocity of modes propagated in the (κ, $\kappa+\pi/2$, Z) axial set with the uniaxial stresses also applied in this reference frame. The approach has been used to determine the 12 transformed third order elastic constants of scheelite ($CaWO_4$). (15 refs.)

67115 Saturation of relaxation absorption in amorphous metals at very high acoustic powers. W.Arnold (Fraunhofer-Inst. for Non-Destructive Testing, Univ. der Saarbruecken, Saarbruecken, Germany), P.Doussineau, A.Levelut.
J. Phys. Colloq. (France), vol.43, no.C-9, p.553-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Strong non-linear effects recently observed in the acoustic absorption in amorphous PdSiCu and other amorphous metals are explained. The authors propose that saturation of the relaxation absorption due to tunneling sites might occur, when the acoustic power becomes so large that the whole ensemble of two level systems (TLS) is saturated up to energy splittings of the order of kT. (9 refs.)

67116 Elastic anomaly near zero-gap state in narrow-gap semiconductors. K.Kumazaki, Y.Abe (Dept. of Engng. Sci., Hokkaido Inst. of Technol., Sapporo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.438-40 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The sound velocities of $Cd_xHg_{1-x}Se$ narrow-gap semiconductors for $0<x<0.6$ are measured at room temperature. The reduced elastic constants derived from sound velocities show an anomaly near zero-gap point, which is not explained by modified valence-force-field theory. This elastic anomaly is well described by calculation based on the zero-gap properties through dynamic dielectric function and complex band structure. (10 refs.)

67117 Hydrogen motion in single-crystal palladium hydride as studied ultrasonically. R.G.Leisure, T.Kanashiro, P.C.Riedi, D.K.Hsu (Dept. of Phys., Colorado State Univ., Fort Collins, CO, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4872-82 (15 April 1983).
The attenuation of ultrasonic waves has been investigated in single-crystal α'-phase palladium hydride ($PdH_{0.64}$) over the temperature range of 77-300K. The longitudinal and two independent transverse waves were propagated along the [110] crystal axis. These correspond to the elastic constants $C_L=1/2(C_{11}+C_{12}+2C_{44})$, $C'=1/2(C_{11}-C_{12})$, and C_{44}. Attenuation peaks were observed for all three modes. At 10 MHz the maxima occurred at approximately 190K for C_L and C', and 180K for C_{44}. The peaks are attributed to a stress-induced ordering of hydrogen pairs and complexes, and vacancy pairs anc complexes, on the hydrogen sublattice. The relative magnitudes of the peaks are well accounted for in terms of hydrogen-hydrogen, hydrogen-vacancy, and vacancy-vacancy interactions at nearest- and next-nearest-neighbor positions. A simple nearest-neighbor interaction is shown to be inadequate to explain the results. The gradients of the hydrogen-vacancy interaction energies at nearest- and next-nearest-neighbor sites are deduced, with the main uncertainty having to do with the selection of an anelastic critical temperature in the theoretical expression. Using 50K for the critical temperature the authors find 5.4×10^{-11} and 3.8×10^{-11} N for the absolute value of the gradients at nearest- and next-nearest-neighbor sites, respectively. The three measured attenuation peaks were found to satisfy a Cauchy-type relationship. Such a relationship suggests a central-force description of the interactions among hydrogen atoms and vacancies. The existence of a hydrostatic mode of relaxation is shown for the first time for this system. The relaxation rate for this mode is approximately the same as that for C_L and C', while the C_{44} mode relaxes approximately twice as fast. Plots of the attenuation times the temperatures versus inverse temperature are asymmetric. The data, taken at higher frequencies and thus higher temperatures, can be fitted using an anelastic critical temperature, but the value is considerably higher than that deduced from the internal-friction experiments. The difference suggests that the asymmetry is not due to a critical temperature, but has some other origin. (32 refs.)

67118 Damping and dispersion of sound at structural transitions. H.Iro, F.Schwabl (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Solid State Commun. (USA), vol.46, no.2, p.205-8 (April 1983).
The attenuation and dispersion of ultrasonic modes in the vicinity of structural phase transitions is studied. The authors perform the first systematic renormalization group calculation of the relevant scaling functions appropriate for perovskites, $n=3$, and for tetragonal systems $n=2$ and 1 with n the number of order parameter components, properly describing the high and low frequency limits. A novel dynamical matching formalism is introduced in the derivation of these results. (18 refs.)

67119 Absorption of ultrasound in diamagnets containing paramagnetic impurities. L.L.Buishvili, N.O.Sepashvili, E.Kh.Khalvashi (State Univ., Tbilisi, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1652-4 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2916-19 (Oct. 1982). [received: April 1983]
A study is made of the interaction of ultrasound with host nuclei in diamagnets diluted with paramagnetic impurities. It is shown that the nuclear line width is governed by the electron dipole-dipole interaction. (10 refs.)

67120 Electric field effect on sound rate in substances with high dielectric constant. A.A.Demidenko, A.P.Zdebskii, V.N.Puskovoi, A.U.Savchuk.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.465-7 (March 1983). In Russian.
The resonance-antiresonance method was used to measure the dependences of sound speed on the constant electric field in substances with high dielectric constant in the case of longitudinal oscillations in a rod in a transverse electric field. The results obtained are compared with curves calculated using results from measuring the second order electrostriction coefficients. (5 refs.) *V.G.P.*

Electret microphone for use in photoacoustic spectrometer and photoacoustic spectrum of some rare earth oxide powders ... See Entry 64963

Pressure variation of the elastic moduli of the sodium halides ... See Entry 67090

The temperature dependence of the elastic constants for highly oriented pyrolytic graphite determined by ultrasonic techniques ... See Entry 67091

Amplitude-dependent ultrasound absorption and acoustoplastic effect during active deformation of sodium chloride crystals ... See Entry 67107

A continuum mechanical approach to the ultrasonic relaxation of ferrolectric materials ... See Entry 67121

Study about the onset of intermediate valency in $TmSe_{0.32}Te_{0.68}$ under pressure ... See Entry 67454

The effect of charged additives on the mobility gap and thermal activation energy of $As_2Se_3Cu_x$ ... See Entry 68161

Brillouin scattering observation of phonon scattering by inhomogeneities in phase separated glasses ... See Entry 68246

Luminescence quantum efficiency of Mn^{2+} states in ZnS as studied by photoacoustic spectroscopy ... See Entry 68301

62.80 ULTRASONIC RELAXATION

(see also 74.30G Ultrasonic attenuation in superconductors, 43.35 Ultrasonics)

67121 A continuum mechanical approach to the ultrasonic relaxation of ferrolectric materials. K.Tanaka, M.Tanaka (Osaka Univ., Osaka, Japan).
Arch. Mech. (Poland), vol.34, no.1, p.49-60 (1982).
The ultrasonic relaxation of an electrically polarizable, non-heat conducting, deformable materials is studied at uniform constant temperature below the Curie point from the point of continuum mechanics. The dissipative quantities are assumed to be determined from the dissipation potential, while the reversible quantities are specified, as usual, by the free energy. The relaxation time and the equation for the phase velocity are derived. The theory is applied to tryglycine sulfate, in order to discuss in detail the relaxation phenomena as well as the ultrasonic absorption. (17 refs.)

67122 Acoustic relaxation in a mixture having a lower critical solution point. Yu.S.Manutcharov, I.G.Mikhailov, V.A.Solov'ev, R.K.Turniyazov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.88-91 (Feb. 1983). In Russian.
Using reverberation and pulse methods an ultrasonic absorption has been measured in 2,6-lutidine-water mixture at critical concentration in the frequency range 05 to 1000 MHz. A single curve for reduced absorption vs. reduced frequency has been obtained which shows the rearrangement in concentration fluctuations to be the main relaxation mechanism. An additional irreducible relaxation process has been found at low frequencies and temperatures. It can be attributed to complex formation. No measurable contribution of entropy fluctuations to sound absorption has been found. (9 refs.)

Ultrasound absorption in polystyrene solutions near the miscibility coexistence curve and critical point ... See Entry 67112

Saturation of relaxation absorption in amorphous metals at very high acoustic powers ... See Entry 67115

63.00 LATTICE DYNAMICS AND CRYSTAL STATISTICS

(see also 05.50 Lattice theory, 65. Thermal properties, 66.70 Thermal conduction, 68.30 Dynamics of surface and interface vibrations, 78.30 Infrared and Raman spectra)

63.10 GENERAL THEORY

67123 Dynamical structure factor of a one-dimensional harmonic liquid: comparison of different approximation methods. G.Radons, J.Keller, T.Geisel (Inst. fur Theoretische Phys., Univ. Regensburg, Regensburg, Germany).
Z. Phys. B (Germany), vol.50, no.4, p.289-96 (1983).
The authors calculate the dynamical structure factor of a linear chain of particles with harmonic interactions, a model which is frequently discussed for $Hg_{3-\delta}AsF_6$ and superionic conductors. $S(q,\omega)$ either consists of a quasielastic peak or of an inelastic peak with finite halfwidth. Based on numerically exact results they compare different approximation methods—a continued fraction expansion and a mode-coupling approximation. It turns out that at small wave vectors the mode-coupling approach leads to wrong results even qualitatively. Otherwise both methods are well suited to describe the liquid-like behaviour of the system. The authors also present a new method to terminate continued fractions which is able to provide a fast convergence. (17 refs.)

63.20 PHONONS AND VIBRATIONS IN CRYSTAL LATTICES

67124 Application of the polarisable-ion model on crystals with the corundum structure. H.A.Lauwers, L.Van Haverbeke, M.A.Herman (Lab. Inorganic Chem., Univ. of Antwerp, Antwerp, Belgium).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.489-96 (1983).
Reports the results of charge, polarisability and force constant calculations at $\vec{k}=0$ on crystals with the corundum structure. Published vibrational frequencies are used in the normal coordinate treatment. The calculated electronic parameters are discussed. (36 refs.)

67125 Ab initio determination of static, dynamic and dielectric properties of semiconductors. K.Kunc (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France), R.M.Martin.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.511-16 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Recent applications of local density functional theory to structure-related properties of semiconductors are reviewed with emphasis upon the authors' own results using the 'direct' method. This approach has provided a unified framework for ab initio calculations for crystals, surfaces, and molecules, with no essential approximations beyond the local form of the density functional. The quantities which have been calculated include the lattice constant, frequencies and pressure coefficients of phonons at high symmetry k-points, eigenvectors of phonon modes, anharmonicity, soft-mode phase transitions, sets of interplanar forces determining entire phonon dispersion branches, and macroscopic dielectric properties including effective charges and static dielectric constants. The results are illustrated and compared with experiment for GaAs. (21 refs.)

67126 The lattice dynamics of substitutional tin on the two different lattice sites in III-V compound semiconductors. G.Weyer, J.W.Petersen, S.Damgaard (Inst. of Phys., Univ. of Aarhus, Aarhus, Denmark).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.523-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A site-selective implantation technique has been utilized to incorporate amphoteric tin impurities on the two inequivalent lattice sites in six III-V compound semiconductors. Debye temperatures for ^{119}Sn have been determined by Mossbauer emission spectroscopy. From a comparison of these values to values calculated by means of the mass-defect model on the basis of Debye temperatures for the two host atoms from neutron-scattering experiments, force constants for the impurity atoms have been extracted by an Einstein-Debye Ansatz. Both lower and higher force constants are deduced for the tin impurities as compared to host force constants. Larger force constants are found on V sites than on III sites for tin in gallium compounds, whereas the opposite holds for the indium compounds. (14 refs.)

67127 Measurements of dispersive phonon transport in gallium phosphide. B.Stock, R.G.Ulbrich (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.540-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors present experiments of energy transport by near zone-edge phonons generated in the process of nonradiative e-h pair recombination at T=1.3K in GaP. Their results show ballistic dispersive transport of phonons with frequencies up to 2 THz depending on orientation and distance. (8 refs.)

67128 Effect of anharmonic lattice vibrations on the interaction of spins via a phonon field. A.F.Izmailov, A.R.Kessel' (Physicotech. Inst., Acad. of Sci., Kazan, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1548-50 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2732-7 (Sept. 1982). [received: April 1983]
The potential of an indirect interaction of spins via a phonon field in an anharmonic lattice is derived. It is shown that the lattice anharmonicity contributes to the potential of the indirect interaction of spins via a phonon lifetime τ_{ph}. It is also shown that τ_{ph} appears in the most slowly decaying term of the indirect interaction potential and leads to its exponential cutoff at large distances. The second moment of the magnetic resonance line due to an indirect interaction of spins is calculated including the effect of a finite phonon lifetime. (5 refs.)

The effects of anisotropic atom-atom interactions on the crystal structure and lattice dynamics of solid CS_2 ... See Entry 66944

Hole-burning Stark spectroscopy of the 5770 Å colour centre in NaF ... See Entry 66986

Lattice dynamics in second-stage bromine-graphite intercalation compound ... See Entry 67143

Dynamics of ions of the two-dimensional superionic conductor $AgCrS_2$ ... See Entry 67281

Excitons in polar semiconductors ... See Entry 67467

Excitonic polarons and core excitons: dielectric relaxation and optical transitions ... See Entry 67468

Polaronic versus bare excitons: a functional-integration approach to the exciton-phonon problem ... See Entry 67469

Relaxation of hot excitons in polar semiconductors ... See Entry 67475

Role of composition fluctuations in exciton spectroscopy of solid solutions of semiconductors ... See Entry 67476

Theoretical analysis of optical-phonon deformation potentials in semiconductors ... See Entry 67484

Relaxation of fast electrons in semiconductors at coupled plasmon-phonon oscillations ... See Entry 67583

Phonon echoes in piezoceramic lead-zirconate titanate ... See Entry 67700

Spin-cyclotron-phonon resonance in semiconductors with inversion asymmetry ... See Entry 68030

Temperature dependence of ^{35}Cl NQR in 2,6-dichloropyridine ... See Entry 68069

Scattering activities and symmetry of skeletal stretching vibrations of long chain molecules by Raman spectroscopy ... See Entry 68195

An improved analysis of the OH stretching spectrum of amorphous solid water ... See Entry 68197

Lifetimes of LO phonons in GaP ... See Entry 68217

Theory of electronic Raman scattering from $n\text{-}KTaO_3$ ... See Entry 68218

Vibration spectra of 2-pyridinethione, 3-pyridazinethione and 2,4-dithiouracile ....See Entry 68235

Vibrational spectrum of barium nitrite hydrate $Ba(NO_2)_2.H_2O$ crystals ....See Entry 68241

Theory of free-electron optical absorption in n-InSb .... See Entry 68260

Vibronic sidebands in ruby ....See Entry 68291

The impurity-induced luminescence of $RbMnF_3$ ....See Entry 68297

63.20D Phonon states and bands, normal modes, and phonon dispersion

67129 Calculation of phonon spectrum using the recursion method. S.Y.Wu (Dept. of Phys., Univ. of Louisville, Louisville, KY, USA), Zheng Zhao-bo.
Acta Phys. Sin. (China), vol.32, no.1, p.46-56 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The phonon spectra of crystalline solids with bcc, fcc and diamond structures were calculated using the recursion method. The result of the calculation demonstrated the feasibility of this method in treating complicated systems. This work also provided a base for applying the method to study the dynamics and electronic structure of amorphous systems. (7 refs.)

67130 Phonon dispersion in rare gas solids. D.Singh, R.P.S.Rathore (Dept. of Phys., RBS Coll., Agra, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.926-9 (Dec. 1982). [received: April 1983]
Four shell models each comprising only four disposable parameters are developed. These parameters defining repulsive, attractive and unpaired interactions are evaluated in terms of the elastic and the equilibrium relations. Cohesion, Cauchy's discrepancy, compressibility, lattice stability and phonon dispersion are explained adequately. (28 refs.)

67131 Elastic anisotropy and phonon dispersion effects in iron and tungsten. S.N.Mehrotra (Dept. of Phys., Regional Inst. of Technol., Jamshedpur, India), S.Tolpadi.
Indian J. Pure & Appl. Phys., vol.20, no.10, p.769-73 (Oct. 1982). [received: April 1983]
A new graded mesh method (GMM) which uses a 91-direction approximation in 1/16th part of the Brillouin zone (BZ) is suggested for evaluating the BZ sums. The BZ is subdivided into three sub zones such that the volumes of the subzone closest to the centre of the zone and the next two subzones are in the ratio 1:124:7875. The wave vectors chosen in these three subzones for the evaluation of the BZ sums are 8736, 8736, and 17472 respectively. A 91-direction approximation is also used to calculate the long wavelength wave velocities and the elastic Debye temperature θ_0 of cubic crystals. The GMM is used to calculate the two parameters α and β which give the percentage effect of phonon dispersion and lattice anisotropy on the lattice specific heat of Fe and W. The calculations show that α is positive and β is negative throughout the temperature range. It is further observed that α shows a maximum and β a minimum when (T/θ_0) is nearly equal to 0.1 and 0.2 respectively. (15 refs.)

67132 Lattice dynamical calculation of the phonon dispersion in sodium halide crystals. R.S.Narayanan, H.C.Gupta, B.B.Tripathi (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.777-9 (Oct. 1982). [received: April 1983]
A lattice dynamical calculation has been presented for the phonon dispersion and the elastic constants of the sodium halide crystals. In addition to the Coulomb interaction, the overlap interaction as derived on quantum mechanical principles has been considered. The combination of electrostatic energy and overlap interaction gives a fairly good account of the shear elastic constant and the phonon spectra of the sodium halides. (14 refs.)

67133 Shift operator techniques for the classification of multipole-phonon states. XI. Properties of mixed type quadratic product operators in R(7). J.Van der Jeugt, H.E.De Meyer, G.Vanden Berghe (Rijksuniv.-Gent Krijgslaan, Gent, Belgium).
J. Math. Phys. (USA), vol.24, no.5, p.1339-44 (May 1983).
For pt.X see ibid., vol.23, p.1223 (1982). Expressions connecting R(3) scalar and nonscalar product operators of the type $P^j_{l+k}O_l^k$ and $O^k_{l+j}P_l^j$ are constructed within the group R(7). (12 refs.)

67134 Shift operator techniques for the classification of multipole-phonon states. XII. O_l^0 eigenstate and eigenvalue determination in R(7). J.Van der Jeugt, G.Vanden Berghe, H.E.De Meyer (Rijksuniv.-Gent Krijgsláan, Gent, Belgium).
J. Math. Phys. (USA), vol.24, no.5, p.1345-9 (May 1983).
For pt.IX see ibid., vol.24, p.1339-44 (1983). On account of previously derived relations between quadratic shift operator products of the type $P^j_{l+k}O_l^k$, $O^k_{l+j}P_l^j$, and $O^k_{l+j}O_l^j$ in the group R(7), part of the eigenvalue spectrum of the scalar shift operator O_l^0 is derived in closed form. The corresponding eigenstates which are closely related to the octupole-phonon state vectors are defined in terms of angular momentum lowering shift operator actions upon the maximum angular momentum states. In the case of l-degenerate state the relation between the previously constructed P_l^0 eigenstates and the derived O_l^0 eigenstates is discussed. A short comment on a numerical method for O_l^0 eigenvalue determination is included. (10 refs.)

67135 Perturbation-theoretical model calculation of the lattice mechanics of low polarisability ionic crystals. D.Bose (Dept. of Phys., Presidency Coll., Calcutta, India), A.Ghosh, A.N.Basu.
Phys. Status Solidi b (Germany), vol.116, no.1, p.313-22 (1 March 1983).
Starting from the Hartree-Fock wave functions of free ions different lattice mechanical properties of a low-polarisability ionic solid, namely the RbF crystal are calculated within the framework of the perturbation-theoretical-model approach of ionic solids developed by Basu and Sengupta (1980). In a recent investigation it is shown that the dipolar polarisation in an ionic solid may be additively decomposed into three parts, two short range polarisation effects and a long range one apart from the displacement polarisation. From an analysis of the Szigeti relations it is found that both the short range polarisation effects in the low polarisability ionic crystals are small compared to those in high polarisability crystals. This fact leads to a major simplification in calculation for this group of solids. The overall agreement obtained broadly justifies the approximations. Since no crystal property is used to obtain the parameter the discrepancies cleary indicate the regions where the omitted interactions are important. Finally a critical analysis of the results is presented and the difficulties of the existing phenomenological models for these solids are also discussed. (22 refs.)

67136 Neutron, X-ray and lattice dynamical studies of paraelectric Sb_2S_3. K.R.Rao, S.L.Chaplot (Nuclear Phys. Div., Bhabha Atomic Res. Centre, Bombay, India), V.M.Padmanabhan, P.R.Vijayaraghavan.
Pramana (India), vol.19, no.6, p.593-632 (Dec. 1982). [received: April 1983]
Neutron and X-ray diffraction studies of Sb_2S_3 indicate extensive diffuse scattering in the plane perpendicular to the chain axis of polymer-like $(Sb_4S_6)_n$ molecules. The authors have examined the possible dynamical origin by recourse to lattice dynamical studies. Dispersion relation of phonons along the three symmetry directions a^*, b^* and c^* is evaluated based on a lattice dynamical model incorporating Coulomb, covalent and a Born-Mayer-like short range interaction. Group theoretical analysis based on the group of neutral elements of crystal sites (GNES) was essential in order to examine and aid in the numerical computations. The group theoretical technique involving GNES extended to 'pseudo-molecular' systems is also discussed in this context. The phonon dispersion relation shows that there are rather flat TA-TO branches of very low frequency in the a and c directions which may give rise to diffuse scattering. The branches along the b-axis are quite dissimilar to those along a and c axes because of anisotropy. Variation of the potential parameters leads to instability of the lowest TA-TO branch. This is suggestive of a temperature or pressure-dependent phase transition. (35 refs.)

67137 Lattice dynamics of black phosphorus. A.Morita, C.Kaneta, H.Katayama-Yoshida (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.517-19 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A force-constant model calculation of the phonon dispersion and frequency distribution function of black phosphorus, which is a narrow-gap and layer-like semiconductor, is presented. In calculation, the authors assume the valence force model for intralayer atomic interactions and the axially symmetric force model for interlayer ones. The calculated results explain experiments on optical phonons, specific heat and second-order Raman spectrum satisfactorily and sound velocities semi-quantitatively. Large discrepancy between theory and experiment on the linear compressibilities exists. (17 refs.)

67138 Lattice vibrations of thin ionic slabs of GaAs. G.Kanellis, J.-F.Morhange, M.Balkanski (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.534-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors calculate the lattice vibrations of thin ionic slabs of GaAs on the basis of a rigid-ion model fitted on the phonon dispersion curves of the infinite crystal. Long-range forces are recalculated and a Valence Force-Field model is used as an intermediate step to calculate the short-range interaction of atoms lying near the surfaces. For sufficiently thick slabs (~20 layers), they find that all optic and acoustic modes fall on the dispersion branches of the infinite lattice, while the four surface modes have frequencies in the gap at the corresponding zone edge point. The results are discussed in comparison with former calculations. (3 refs.)

67139 Microscopic calculation of the phonon frequencies of silicon, including exchange and correlation. P.E.Van Camp (Univ. of Antwerpen, Antwerp, Belgium), V.E.Van Doren, J.T.Devreese.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.537-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Phonon frequencies of Si are calculated in the dielectric screening theory. Electron energies and wavefunctions are obtained from a self-consistent pseudopotential band calculation. The lattice constant is evaluated from minimalization of the total ground state energy. In order to guarantee consistency exchange and correlation are treated in the local density functional formalism both in the Hamiltonian and in the linear response theory. Results of the Γ, X and $\vec{q}={}^{2\pi}/_{a}$ (0.4,0,0) phonons are presented and compared with earlier calculations. (13 refs.)

67140 Raman probe of the large wavevector TA phonon bottleneck in GaAs. K.T.Tsen, D.A.Abramsohn, R.Bray (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.543-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have probed the modes, frequencies and populations of nonequilibrium large wavevector TA phonons in GaAs, participating in the bottleneck in decay at low temperature. The excess phonons were generated as a by-product of intense pulsed Nd:YAlG laser excitation of electrons from deep traps, and were probed in situ by 90° second-order Raman scattering of the same laser beam.

67141 Lattice dynamics of graphite intercalation compounds. F.Batallan, I.Rosenman, Ch.Simon (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France), H.Lauter, G.Furdin.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.614-16 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have studied using coherent inelastic neutron scattering, the phonon dispersion relation of the second stage bromine graphite intercalation compound. They have observed the almost complete low energy spectrum (<12 THz) with longitudinal and transverse phonons propagating along the direction perpendicular to the layers (c axis) as well as in the layers' plane. The modes polarized along the c axis present energy gaps in the c direction branches and the acoustic branch polarized in the layers' plane, opposite to the optic ones, is very sensitive to the intercalate nature. The main character of the modes polarized in the layers' plane is a dispersionless optic branch along the c direction at 1 THz. A phenomenological Born-von Karman force constant model with nonaxial symmetry is developed in order to interpret the results. (8 refs.)

67142 Pressure dependence of the optical phonon in solid hydrogen and deuterium up to 230 kbar. R.J.Wijngaarden, V.V.Goldman, I.F.Silvera (Natuurkundig Lab., Univ. van Amsterdam, Amsterdam, Netherlands).
Phys. Rev. B (USA), vol.27, no.8, p.5084-7 (15 April 1983).
The authors have studied the E_{2g} transverse-optical phonon by means of Raman scattering in solid molecular hydrogen and deuterium at pressures up to 230 kbar at 5K in a diamond anvil cell. With the use of a self-consistent phonon calculation which incorporates anharmonic corrections to the self-energy, phonon frequencies were calculated using an isotropic intermolecular pair potential. Deviations between theory and experiment point to deficiencies in the potential. The present experimental data can be used as a test on the isotropic part of the intermolecular potential of the solid. (17 refs.)

67143 Lattice dynamics in second-stage bromine-graphite intercalation compound. C.Simon, F.Batallan, I.Rosenman (CNRS, Paris, France), H.Lauter, G.Furdin.
Phys. Rev. B (USA), vol.27, no.8, p.5088-97 (15 April 1983).
The authors have studied by coherent inelastic neutron scattering the phonon spectrum of a second-stage bromine-graphite intercalation compound. The intercalate sample was obtained from highly oriented pyrolytic graphite. They have observed the almost complete low-energy (<12 THz) phonon spectrum with longitudinal and transverse phonons propagating along the *c* direction as well as in the layer plane. They have observed three branches polarized along the *c* axis which present energy gaps a long the *c* direction. The acoustic branch propagating in the layer plane contrary to the optic ones is very sensitive to the intercalate. The main character of the modes polarized in the layer plane is the dispersionless optic branch along the *c* direction at 1 THz. A phenomenological Born-von Karman force-constant model with nonaxial symmetry, developed in order to interpret their results, explains them very well. (22 refs.)

67144 Long-wavelength vibrations in $Pb(MoO_4)_x(WO_4)_{1-x}$ solid solutions. V.M.Nagiev, Sh.M.Efendiev, N.G.Darbishov, N.N.Mel'nik (S.M. Kirov State Univ., Baku, Azerbaidzhan SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1630-1 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2872-4 (Sept. 1982). [received: April 1983]
The results of a Raman spectra study are presented in order to explain the long-wavelength vibrations in $Pb(MoO_4)_x(WO_4)_{1-x}$ solid solutions. The authors give the dependence of the phonon frequencies on solid solution composition and conclude that the highest frequency phonons reveal a double mode behaviour. (8 refs.)

Tentative reconstitution of the crystal structure of benzene, at $-3°C$, by a molecular interaction analysis taking thermal vibration coefficients into account .... See Entry 66977

Study of ion-implanted damage in GaAs:Be and inP:Be using Raman scattering .... See Entry 67023

Ab initio determination of static, dynamic and dielectric properties of semiconductors .... See Entry 67125

Theory of anharmonicity in the lattice dynamics of crystals of rigid molecules .... See Entry 67150

Nonlinear lattice dynamics in two dimensions .... See Entry 67151

Nonrelative dispersion relation in crystals with a diamond structure .... See Entry 67438

Dispersion equation for crystals with diamond structure with spin-orbital interaction taken into account .... See Entry 67439

Charge density anomalies in Si and InSb preceding the high pressure transition .... See Entry 67453

Phonon spectrum analyzer .... See Entry 67863

Infrared spectra of $KNaSO_4$ and $K_3Na(SO_4)_2$ .... See Entry 68203

Raman study of geometrical disorder at semiconductors surfaces .... See Entry 68207

Optical pumping of hot phonons in GaAs .... See Entry 68212

Generalized electronic susceptibility and charge density waves in transition metal dichalcogenides .... See Entry 68219

Chalcogenides and pnictides of group VIII transition metals: far-infrared spectroscopic studies on compounds MX_2, MXY, and MY_2 with pyrite, marcasite, and arsenopyrite structure .... See Entry 68225

Raman scattering spectra of K_2ZnCl_4 .... See Entry 68239

Experimental and theoretical study of Raman scattering in $Hg_2(Cl_xBr_{1-x})_2$ mixed crystals .... See Entry 68240

63.20H Phonon-phonon interactions

Thermal phonon bottleneck and nonlinear current-voltage characteristics of conducting media .... See Entry 67634

63.20K Phonon-electron interactions

67145 Phase diagram of one-dimensional electron-phonon systems. II. The molecular-crystal model. J.E.Hirsch (Inst. for Theoretical Phys., Univ. of California, Santa Barbara, CA, USA), E.Fradkin.
Phys. Rev. B (USA), vol.27, no.7, p.4302-16 (1 April 1983).
For pt.I see ibid., vol.27, p.1680 (1983). The authors study the nature of the ground state of a one-dimensional electron-phonon model for molecular crystals. The phonons are assumed dispersionless and couple to the local electronic density. They consider the half-filled-band sector and discuss the stability of the Peierls-dimerised ground state as a function of the phonon frequency (ω), electron-phonon coupling constant (λ), and number of components of the electron spin (n). First, they discuss the properties of the model in the limiting cases of zero frequency and infinite frequency. They then perform a strong coupling expansion which maps the system onto a spinless fermion model with nearest-neighbour repulsion for both spinless and spin-$^1/_2$ electrons, but with different parameters in both cases. Finally, they perform a numerical study of the system using a Monte Carlo technique. They study the behaviour of the order parameter and of correlation functions for various points in parameter space. They also perfrom a finite-size—scaling analysis of the numerical data. The conclusions of the study are the following: For the case of spinless electrons, there exists always a disordered phase for small coupling constant, and the system undergoes an infinite-order transition to a Peierls-dimerised state as the coupling constant increases beyond a critical value. The phase diagram is divided between a disordered and an ordered region by a line that connects the points ($\omega=0$, $\lambda=0$) and ($\omega=\infty$, $\lambda=\infty$). For the case of spin-$^1/_2$ electrons, the system is dimerised for arbitrary λ and ω except in the limit $\omega=\infty$. (28 refs.)

Instabilities of polarons in high magnetic fields .... See Entry 67485

Thermal phonon bottleneck and nonlinear current-voltage characteristics of conducting media .... See Entry 67634

Instability of the electron-hole plasma in covalent semiconductors .... See Entry 67675

Electron-phonon interaction in superconducting contacts .... See Entry 67859

Spin-cyclotron-phonon resonance in semiconductors with inversion asymmetry .... See Entry 68030

Anisotropy of nonlinear absorption of light by free carriers in *n*-type germanium .... See Entry 68143

Current state of a semiconductor in the field of a strong electromagnetic wave .... See Entry 68165

Effect of non-magnetic impurities on the observation of superconducting gap excitations by Raman scattering .... See Entry 68210

Theory of electronic Raman scattering from n-$KTaO_3$ .... See Entry 68218

Acoustoluminescence spectra of NaCl and KCl crystals .... See Entry 68336

63.20M Phonon-defect interactions

Changes in dislocation and electronic structure during copper consolidation .... See Entry 68474

63.20P Localized modes

67146 Shape dependence of the elastic energy in hydrogen-metal alloys. H.Maier-Botzel, W.Platzer, H.Wagner (Sektion Phys., Univ. Munchen, Munchen, Germany).
Phys. Rev. B (USA), vol.27, no.8, p.5173-5 (15 April 1983).
The authors obtain the exact spectrum of the elastic energy for axially symmetric strain fields due to dilatation centers in isotropic ellipsoidal host metals. The result is a prerequisite for a study of sample-shape-dependent thermodynamic effects as observed in hydrogen-niobium alloys. (11 refs.)

Hydrogen motion in single-crystal palladium hydride as studied ultrasonically .... See Entry 67117

Dissociation of (Zn,O) pairs in GaP .... See Entry 67517

Dynamical theory of recombination-enhanced defect reactions .... See Entry 67524

Effect of anharmonicity and Debye-Waller factor on the superconductivity of PdH_x and PdD_x .... See Entry 67835

Investigation of dislocations in silicon by the ESR method .... See Entry 68019

Effect of non-magnetic impurities on the observation of superconducting gap excitations by Raman scattering .... See Entry 68210

Structure of the short-wave edge of the lattice absorption band in zinc selenide doped with aluminum .... See Entry 68271

63.50 VIBRATIONAL STATES IN DISORDERED SYSTEMS

67147 Linear dispersion of transverse high-frequency phonons in vitreous silica. M.Rothenfusser, W.Dietsche, H.Kinder (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Phys. Rev. B (USA), vol.27, no.8, p.5196-8 (15 April 1983).
Using phonon interference in thin films, the authors have measured the dispersion curve of transverse phonons in vitreous silica. A linear dispersion was found up to 450 GHz. This result has important implications for theories on the specific heat and thermal conductivity of glasses and is consistent with recent model calculations of phonons in a glass. (17 refs.)

67148 Lattice dynamics and conjugation length in trans-polyacetylene. L.Piseri, R.Tubino, L.Paltrinieri (Istituto di Chimica delle Macromolecole, CNR, Milano, Italy), G.Dellepiane.
Solid State Commun. (USA), vol.46, no.2, p.183-8 (April 1983).
A force field for the infinite trans-polyene chain which includes the contribution of delocalized forces is proposed. Phonon energies throughout the Brillouin zone are evaluated and compared with the IR and Raman data of trans-polyacetylene and with the C=C stretching frequencies of a number of short polyenes. The experimental resonant Raman bandshapes for $(CH)_x$ and $(CD)_x$ are well accounted for by the calculated dispersion of the phonon frequencies. Some conclusions on the conjugation length of the polymer are reached. (22 refs.)

Structural investigation of molten and glassy silicates by means of infrared emission spectrometry .... See Entry 66886

Saturation of relaxation absorption in amorphous metals at very high acoustic powers .... See Entry 67115

Correlation between electrical and vibrational properties of chlorinated and hydrogenated amorphous silicon prepared by glow discharge ... See Entry 67598

Evidence for scattering of phonons from magnetic excitations in amorphous spin glasses .... See Entry 67936

Raman studies of B_2O_3 glass structure: $^{10}B\rightarrow{}^{11}B$ isotopic substitution .... See Entry 68205

New silicon hydrogen infrared vibrational band associated to H-Si-Cl configurations in an amorphous silicon matrix: Green's function theory approach .... See Entry 68221

Investigation of large molecular fragments in glassy $Ge_{1-x}(Se, or S)_x$ .... See Entry 68223

Raman scattering in highly disordered amorphous phosphorus .... See Entry 68227

Brillouin scattering observation of phonon scattering by inhomogeneities in phase separated glasses .... See Entry 68246

Brillouin scattering in layered structures .... See Entry 68250

Infrared spectroscopy of amorphous hydrogenated GaAs, GaP, GaSb, evidence for Ga-H-Ga bridges .... See Entry 68281

An investigation of the vibronic frequency distribution function in structurally disordered, solid materials by monochromatic luminescence excitation .... See Entry 68325

Vibrational spectra of defect and allow atom complexes in amorphous silicon films .... See Entry 68346

Infrared absorption spectra for B- and P-doped a-Si .... See Entry 68347

Disorder and optical properties in gallium arsenide .... See Entry 68348

63.70 STATISTICAL MECHANICS OF LATTICE VIBRATIONS

(see also 65. Thermal properties of condensed matter, 66.70 Thermal conduction)

67149 Estimation of the Debye temperature of diamond-like semiconducting compounds from bulk moduli and microhardness. P.Deus, H.A.Schneider (Sektion Phys., Bergakad. Frieburg, Frieburg, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.491-500 (1983).
The reliability of estimations of the Debye temperature θ_D evaluated from bulk moduli and microhardness data is proved for semiconductors with diamond, sphalerite, and chalcopyrite structures. The known linear relations available from the literature do not yield a reasonable agreement between experimental and calculated Debye temperatures. As in the case of the Lindemann rule a better approximation is obtained by use of a more general relation $\theta_D=\alpha_1 x+a_2$. The constants a_1 and a_2 are calculated for the substances under consideration. Unknown Debye temperatures are calculated. (31 refs.)

67150 Theory of anharmonicity in the lattice dynamics of crystals of rigid molecules. S.H.Walmsley (Chem. Dept., Univ. Coll. London, London, England).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.491-8 (15 April 1983).
The use of the rigid-molecule approximation in the theory of lattice dynamics of molecular crystals leads to higher-order kinetic energy terms when anharmonic effects are allowed for. The conventional theory of lattice dynamics is extended to take account of these terms. (4 refs.)

67151 Nonlinear lattice dynamics in two dimensions. D.C.Mattis (Phys. Dept., Univ. of Utah, Salt Lake City, UT, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5158-61 (15 April 1983).
In general, dynamical and quantum-mechanical properties of anharmonic lattices are best expressed in terms of bond variables. A transformation from atomic (site) to bond coordinates is generated in two dimensions, with the help of a number of subsidiary conditions expressed on plaquettes. It is shown that these commute with the Hamiltonian and yield a number of zero-energy modes. With the use of this trick, two-dimensional problems are now only slightly more difficult to study than one-dimensional analogs. The authors discuss some exact results. (7 refs.)

67152 Anisotropy of molecular oscillations as a factor in forming partially ordered structures. V.K.Pershin, Vl.K.Pershin (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1739-41 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3074-8 (Oct. 1982). [received: April 1983]
The analysis of the dynamical equations for a two-dimensional layered molecular crystal is used as the basis for classifying mesophases according to how the lattice dynamically loses its stability. The authors demonstrate the fundamental possibility for forming a partially ordered structure resulting from a mixed translational-librational instability. (25 refs.)

Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4 .... See Entry 66974

The lattice dynamics of substitutional tin on the two different lattice sites in III-V compound semiconductors .... See Entry 67126

Effect of anharmonic lattice vibrations on the interaction of spins via a phonon field .... See Entry 67128

Elastic anisotropy and phonon dispersion effects in iron and tungsten .... See Entry 67131

Effect of anharmonicity and Debye-Waller factor on the superconductivity of PdH_x and PdD_x .... See Entry 67835

Analysis of the Mossbauer-effect probability and the Mossbauer-line symmetry for SnO_2 .... See Entry 68092

63.75 STATISTICAL MECHANICS OF DISPLACIVE PHASE-TRANSITIONS

(for order-disorder and statistical mechanics of model systems, see 64.60; for crystallographic aspects of polymorphic and order-disorder transformations, see 61.50K)

Calorimetric and other studies of phase transitions in solids .... See Entry 67185

Raman spectra and structural phase transitions of the perovskite-type layer compounds $RbAlF_4$ and NH_4AlF_4 .... See Entry 68188

Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine .... See Entry 68198

63.90 OTHER TOPICS IN LATTICE DYNAMICS AND CRYSTAL STATISTICS

Damping and dispersion of sound at structural transitions .... See Entry 67118

Cooperative phenomena: a simple model for phase transitions in solid electrolytes .... See Entry 67162

Study about the onset of intermediate valency in $TmSe_{0.32}Te_{0.68}$ under pressure .... See Entry 67454

Raman spectra and structural phase transitions of the perovskite-type layer compounds $RbAlF_4$ and NH_4AlF_4 .... See Entry 68188

Phase transition and vibrational spectra of l-leucine .... See Entry 68189

Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine .... See Entry 68198

Brillouin scattering investigation of paraelectric KH_2PO_4 near the tricritical point .... See Entry 68248

64.00 EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS

(see also 82.60 Chemical thermodynamics)

64.10 GENERAL THEORY OF EQUATIONS OF STATE AND PHASE EQUILIBRIA

67153 The critical points of cubic equations of state for pure fluids. M.A.J.Michels, H.Meijer (Koninklijke/Shell-Lab., Amsterdam, Netherlands).
Fluid Phase Equilibria (Netherlands), vol.11, no.1, p.19-27 (April 1983).
The critical point of an equation of state for a pure fluid generally has to be calculated from three coupled relations between the critical constants V_c, p_c and T_c. It will be shown that for any cubic equation of state these relations may be decoupled in such a way that only one relation for T_c has to be solved, whereupon V_c and P_c follow by direct substitution. For cubic equations with a Van der Waals-type repulsive term a second form of the solution is given. As examples the equations of Redlich and Kwong (1949), of Ishikawa, Chung and Lu (1980), and of Kumar (1980) are considered. (9 refs.)

67154 A four-parameter equation of state. Y.Adachi, B.C.-Y.Lu (Dept. of Chem. Engng., Univ. of Ottawa, Ottawa, Ontario, Canada), Hidezumi Sugie.
Fluid Phase Equilibria (Netherlands), vol.11, no.1, p.29-48 (April 1983).
A new equation of state which contains four parameters and remains cubic in terms of volume has been developed and successfully applied to the representation of properties of pure components (compressibility factor, fugacity coefficient, enthalpy departure, vapor pressure, and saturated liquid and vapor volumes) and mixtures (vapor-liquid equilibria and compressibility factor). The pure component parameters have been evaluated on the basis of optimal representation of the critical isotherm, and correlated in terms of critical temperature, critical pressure and the acentric factor. The mixing rules used include only one binary interaction parameter, the values of which have been obtained for twenty-six binary mixtures. (50 refs.)

64.30 EQUATIONS OF STATE OF SPECIFIC SUBSTANCES

(see also 65.70 Thermal expansion)

67155 Equation of state for fluid hydrogen-isotopes H_2, D_2, and T_2 up to their freezing points at 300K. H.Shimizu, T.Kumazawa (Dept. of Electrical Engng., Gifu Univ., Gifu, Japan).
J. Chem. Phys. (USA), vol.78, no.7, p.4632-6 (1 April 1983).
The calculations of the *P-V* isotherms of fluid hydrogen isotopes H_2, D_2, and T_2 up to their freezing pressures around 55 kbar at 300K have been performed by using the modified hard-sphere variational perturbation theory with a quantum correction for four kinds of intermolecular potentials. The results by the use of the potentials of Silvera-Goldman (1978) and Nellis et al. agreed well with the experimental equation of state. The quantum pressures (ΔP) were estimated as a function of volume for H_2, D_2, and T_2 at 300 and 200K, and the dependences of ΔP on volume, molecular mass, and temperature were discussed. (25 refs.)

67156 T-P-C state diagram of the V-Mn system in the ordering range. A.K.Butylenko, I.Yu.Ignat'eva.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.461-3 (March 1983). In Russian.
The temperature dependence of electrical conductivity of V-Mn alloys with Mn concentration between 20-60 at.% were used to construct a T-P-C state diagram upto 80 kbar. It is shown the ordering temperature T_c sign change with pressure is determined by the sign of the relative alloy volume change during ordering $\Delta V/V_0$ (ΔV—volume difference between ordered and disordered phases). The quantity dTc/dp depends on the degree of alloy deviation from equal-atom composition for which $\Delta V/V_0$ is a maximum. (9 refs.)
V.G.P.

Mesoscopic kinetic theory of polymer melts .... See Entry 66791

Prediction of thermodynamic properties of normal paraffins using only normal boiling point .... See Entry 67235

64.60 GENERAL STUDIES OF PHASE TRANSITIONS

(for critical phenomena in quantum fluids, superconductors, magnetic materials and ferroelectrics, see 67., 74.40, 75.40 and 77.80 respectively)

67157 A statistical theory of the Collins' model in the phase transition of two-dimensional system. Du Yi-jing, Chen Li-rong, Yan Zu-tong (Dept. of Phys., Anhwei Normal Univ., Wuhu, China).
Acta Phys. Sin. (China), vol.32, no.1, p.96-102 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
By using the Collins' model, Kawamura (1980) had studied the phase transition of a two dimensional system. In this work, taking into account the molecular fraction and the presence of the 4-atom, the authors calculated the Gibbs free energy and studied, the influence of the percent of 4-atom on the parameters of the triple point and the critical point. They obtain a phase diagram showing three phases with a triple point and a critical point. The relation between the extent of each phase and the temperature is calculated along each transition line. The obtained results are quite analogous to the behavior of the three-dimensional substances. (4 refs.)

67158 Computer coupling of phase diagrams and thermodynamics. A.D.Pelton (Ecole Polytech., Montreal, Quebec, Canada).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.183-8 (March 1983).
There has been much progress in the coupling of thermodynamics and phase diagrams. The development of solution models, of analytical and numerical techniques, and of computer software has now advanced sufficiently that it is possible to express the Gibbs energies of a wide variety of phases as functions of the state variables and to calculate multicomponent phase diagrams therefrom with good pecision for many systems. This approach presents several advantages. Thermodynamic data and phase diagram measurements for a system can be critically assessed simultaneously. Once a set of thermodynamic functions has been compiled for a system, these can be extrapolated to calculate phase diagrams ouside the ranges of *T*, *P*, composition, partial pressures, etc. of the measurements, or to compute metastable phase boundaries. *N*-component phase diagrams can be estimated from the properties of their (*N*-1)-component sub-systems. (23 refs.)

67159 On diffuse phase transitions and hybrid crystal formation. A.J.Burggraaf (Dept. of Chem. Engng., Twente Univ. of Technol., Enschede, Netherlands).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.208-13 (March 1983).
A review and short discussion is given of a particular type of phase transition called a diffuse phase transition and of microstructures which may give rise to it. Special attention is paid to microdomains and hybrid crystal formation. Experimental evidence from literature is reviewed. Results on some ferroelectric and ion conductive materials are summarised and discussed in more detail. (49 refs.)

67160 Kinetics of a unidirectionally inhomogeneous Ising alloy. C.M.van Baal (Lab. of Metall., Delft Univ. of Technol., Delft, Netherlands).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.218-21 (March 1983).
A new way of treating kinetic problems in crystalline systems, applied earlier to homogeneous systems (Physica, vol.111A, p.591, 1982), here is applied to the Hillert model of an alloy i.e. to a model in which it is assumed that inhomogeneities in composition only exist in one crystal direction. For this model the diffusion equations are derived and shown to lead to equilibrium. The equations are solved in linear approximation. The solutions are unstable inside the spinodal and have characteristics that are in very good agreement with the Cahn-Hilliard theory of spinodal decomposition. (13 refs.)

67161 Irradiation-driven phase transformations in alloys. H.Wollenberger (Hahn-Meitner-Inst. fur Kernforschung Berlin, Berlin, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.229-32 (March 1983).
Energetic particle irradiation produces supersaturation of vacancies and interstitials. The migrating defects annihilate at internal sinks and surfaces forming fluxes to the annihilation sites. Such defect fluxes may cause atomic redistribution in alloys due to an inverse Kirkendall effect. Local instability of the solid solution and precipitation may result. This mechanism is not confined to defect annihilation at sinks but might operate also for vacancy interstitial recombination. An entirely different mechanism of phase transformation is induced by the atomic mixing effect occurring within the irradiation produced atomic collision cascades. Long range ordered precipitations can be dissolved that way. (17 refs.)

67162 Cooperative phenomena: a simple model for phase transitions in solid electrolytes. A.Bunde (Fakultat fur Phys., Univ. Konstanz, Konstanz, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.240-4 (March 1983).
The influence of cooperative effects on the transitions of ionic crystals to a highly conductive solid electrolyte state is investigated within the framework of a simple model describing one type of ions as a lattice gas in a vibrating cage formed by the other type of ions. The formation of a solid electrolyte is interpreted as an order-disorder phenomenon among the lattice gas ions. At low temperatures these are localized at certain lattice sites, while at high temperatures they are distributed over numerous interstitial sites. According to the number of equivalent and nonequivalent interstitial sites and, in particular, depending on the mutual interactions among the ions, the following transitions to the solid electrolyte state may occur: (I) gradual transitions, (II) one transition of first order, and (III) two successive transitions of first order. (30 refs.)

67163 Functional integral approach to the Falicov-Kimball model. H.S.Wio (Centro Atomico Bariloche, Bariloche, Argentina).
Z. Phys. B (Germany), vol.50, no.4, p.357-61 (1983).
Using the functional integral method of Hubbard-Stratonovich, the author has studied the existence of first order phase transitions in the Falicov-Kimball model. By means of two different approximation he has obtained results at variance. The first approximation, that is called uniform, is like a mean field one; and the second, a self-consistent one, is similar to the coherent potential approximation. (12 refs.)

67164 The choice of composition variable comparing the Walker and Vause model to binary liquid mixtures having closed-loop coexistence curves. R.G.Johnston, M.R.Meadows, R.C.Mockler, W.J.O'Sullivan (Dept. of Phys., Univ. of Colorado, Boulder, CO, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.575-8 (22 April 1983).
By using unconventional composition variables, the authors have extended the application of the Walker and Vause model (1980) to include binary liquid mixtures having highly asymmetric closed-loop coexistence curves. They offer a plausibility argument supporting the use of these composition variables. (24 refs.)

67165 A molecular theory for the freezing of hard spheres. A.D.J.Haymet (Dept. of Phys., Harvard Univ., Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4641-8 (1 April 1983).
Using statistical mechanics and a series of well-defined approximations the author presents a calculation of the equilibrium liquid to solid transition for hard spheres. No computer simulation results are used. The transition is located from structural information about the liquid using a first-principles order parameter theory of freezing. The order parameters are the coefficients of a Fourier expansion of the spatially varying single-particle density $p(\mathbf{r})$ in terms of the reciprocal lattice vectors of the solid. The thermodynamic and structural properties are calculated from a perturbation expansion in $p(\mathbf{r})$. The effects of second order terms in this expansion and intermediate wavelength properties are investigated for the first time. The theory predicts that the equilibrium freezing transition occurs from a liquid with density 0.976 to an fcc solid of density 1.035 (in units of σ^3, where σ is the hard sphere diameter), in good agreement with monte Carlo simulations which find empirically that the liquid at a density 0.939-0.948 has the same pressure and free energy as the solid at a density 1.036-1.045. (32 refs.)

67166 Gas bubble formation in nonequilibrium water-gas solutions. Ho-Young Kwak, R.L.Panton (Mech. Engng. Dept., Univ. of Texas, Austin, TX, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5795-9 (1 May 1983).
The paper concerns the nonequilibrium situation that is created by suddenly reducing the pressure of a liquid which contains a large amount of dissolved gas. A theoretical model for the resulting formation of gas bubbles is presented. For a given temperature, the model predicts the amount of pressure reduction required for the threshold of bubble formation and also the reduction required for massive bubble formation. With a few extra assumptions the model will also describe the temperature dependence of these pressure reductions. Results from the model show good agreement with experiments for various gases dissolved in water solutions. (18 refs.)

67167 Group-subgroup phase transitions, Hermann's space-group decomposition theorem, and chain subduction criterion in crystals. S.Deonarine, J.L.Birman (Dept. of Phys., City Univ. of New York, New York, NY, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4261-73 (1 April 1983).
Direct determination of allowed continuous symmetry-breaking transitions among crystallographic space groups is systematised by using the decomposition theorem of Hermann (1929), according to which every subgroup of a space group is a class-equivalent (Klassengleich) subgroup of a translation-equivalent (Zellengleich) subgroup of the parent group. The theorem provides a structure in the lattice of maximal space subgroups of a parent space group needed for studies of phase transitions between a space group and its space subgroups. With the use of this structure, a systematic application of the chain-subduction criterion is facilitated. The direct group-theory procedures are illustrated by obtaining all allowed continuous transitions from the parent space group $C_{4h}{}^6$ to any of its space subgroups. Results agree with Lyubarskii's (1960) calculation except in one case where agreement can be obtained by extending Lyubarskii's analysis to include terms of higher (eighth) degree in the Landau free energy. (24 refs.)

Percolation cluster numbers and effective surface tension ....See Entry 64870

Kinetics of glass formation and devitrification behavior ....See Entry 66874

The influence of time dependence of temperature on the kinetics of nucleation ....See Entry 66904

Nucleation and growth of cubic ice in LiCl.n D_2O glasses ....See Entry 66915

Damping and dispersion of sound at structural transitions ....See Entry 67118

Colling rate dependence of the icer I nucleation temperature in aqueous LiCl solutions ....See Entry 67171

Supercritical extraction at atmospheric pressures .... See Entry 67220

Shear viscosities away from the melting line: a comparison of equilibrium and nonequilibrium molecular dynamics ....See Entry 67257

Epitaxial growth of tungsten and tungsten-rhenium alloys from the gas phase ....See Entry 67389

Classical field descriptions of one-dimensional systems ....See Entry 67941

A shifted equilibrium equation for reactions with variable composition phases ....See Entry 68793

64.70 PHASE EQUILIBRIA, PHASE TRANSITIONS, AND CRITICAL POINTS

(see also 81.30 Phase diagrams and microstructures developed by solidification and solid-solid phase transformations)

67168 New phase in SnO_2-P_2O_5 system, [Mossbauer spectra]. A.V.Baluev, I.I.Kozhina, V.S.Mityakhina, B.I.Rogozev.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.110-12 (Feb. 1983). In Russian.
A new phase in the SnO_2-P_2O_5 system has been identified and its interplanar spaces are presented. On the basis of Mossbauer spectroscopy it is assumed that this phase is the oxyphosphate of tin (IV) $Sn_2O_2P_2O_7$. (7 refs.)

67169 Investigation of some cross-sections in the system As-S-Te. A.A.Obraztsov, G.M.Orlova, G.M.Kozhina, L.M.Agamirova.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.113-15 (Feb. 1983). In Russian.
It was found that the cross sections As_2S_3-Te, AsS-Te and AsS-As_2Te_3 of the As-S-Te diagram were quasibinary with eutectic points displaced to the corresponding arsenic sulphides. Large regions of immiscibility were discovered in the sections. AsS-Te and AsS-As_2Te_3 in the range of compositions 5-50 at.% Te and 7-70 mol.% As_2Te_3. (6 refs.)

X-ray investigation of the rare earth metal-iron triad metal-boron systems ....See Entry 66931

Temperature dependence of the sound velocity and ultrasonic attenuation in liquid Bi-Ga and Bi-Sn alloys ....See Entry 67111

T-P-C state diagram of the V-Mn system in the ordering range ....See Entry 67156

Computer coupling of phase diagrams and thermodynamics .... See Entry 67158

Solubility of copper in CdSe .... See Entry 67216

Enthalpies of mixing of ternary systems. III. The system In-Sn-Te ....See Entry 67225

Stoichiometric limits of carbon-rich boron carbide phases .... See Entry 67227

Temperature dependence of the Hall coefficient of CuBe2 between 6 and 300K ....See Entry 67566

Phase diagrams of binary systems of germanium with sodium, potassium, rubidium, and cesium ....See Entry 68504

Isotopic effects in hydrogen-intermetallic compounds systems . See Entry 68505

Solid-liquid-equilibria in the α-range of copper-antimony alloys ....See Entry 68506

Thermodynamic properties of binary alloys of platinum metals. III. Iridium-rhodium ....See Entry 68507

Microstructures of the alloys in the system Pd-In-Sn .... See Entry 68508

The influence of alloy chemistry on controlling fiber volume fraction in Ni-base MC aligned eutectics .... See Entry 68509

Phase equilibria in the system Na_2CO_3-$CaCO_3$-CO_2 at 750 to 900°C ....See Entry 68511

The *P-T* phase diagram of lithium iodate ($LiIO_3$) up to 40 kbars ....See Entry 68512

High-temperature interaction of hafnium nitride with tungsten ....See Entry 68513

Nature of the interaction between lead and zinc chalcogenides ....See Entry 68514

PbTe-Ge section of the Pb-Ge-Te ternary system .... See Entry 68515

Investigation of the p-T-x diagram of the Sn-Se system .... See Entry 68516

Quaternary interacting $A^{II}B^{VI}$ semiconductor systems ....See Entry 68520

Interaction in the Bi_2Te_3-La_3Te_4 system ....See Entry 68523

64.70D Solid-liquid transitions

(see also 81.30F Solidification)

67170 Enthalpies of compounds with compositions close to M_5Ge_3 (M=Mn, Fe, Co, Ni) in temperature interval 500-1400K. Yu.V.Putintsev, A.G.Gofman (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Inorg. Mater. (USA), vol.18, no.5, p.680-3 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.809-11 (May 1982). [received: Feb. 1983]
In adiabatic mixing calorimeters, in an interval of temperatures from 500 to 1400K, the temperature dependence of enthalpy $\Delta H_{298.15}{}^{T}$ has been obtained for the germanides $Mn_{1.67}Ge$, $Fe_{1.76}Ge$, $Co_{1.75}Ge$, and $Ni_{1.86}Ge$, and their heats of fusion have been evaluated. The values established for the heats of fusion are very much different from those calculated by the additivity rule and are also very much different from the heats of fusion of other germanides and silicides that are similar to these germanides in structure. (14 refs.)

67171 Colling rate dependence of the icer I nucleation temperature in aqueous LiCl solutions. D.R.MacFarlane, R.K.Kadlyala, C.A.Angell (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.235-8 (20 Jan. 1983).
The cooling rate dependence of the homogeneous nucleation temperature, T_h, has been determined for several compositions in the system $LiCl/H_2O$. This cooling rate dependence was found to be small except at concentrations close to the edge of the glass-forming range. An explanation of the often observed termination of the T_h curve at $\sim T_g+22K$ is developed. Little prospect is found of improving the vitrification range of cryoprotectant solutions by the imposition of high quench rates. (17 refs.)

67172 Solidification of the Al-In monotectic alloy in a horizontal Bridgman configuration. I. Experimental aspects and structure characterisation. B.Vinet, C.Potard (Dept. de Metall., CENG, Grenoble, France).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.355-61 (March 1983). In French.
The authors report the results of the solidification of Al-In monotectic alloys carried out by the horizontal Bridgman method. These experiments demonstrate that natural convection plays a favourable prominent part in the growth of regular monotectics. They show that it is possible to obtain regular structures (fibres or globules) in massive samples by using low thermal gradients ($\sim$25K cm^{-1}). In particular, original structures have been obtained. They characterize the structures by measuring their geometrical parameters and by seeking their correlations. (15 refs.)

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV) .... See Entry 64592

Solution of a one-dimensional phase change problem with non-uniform initial temperature .... See Entry 64865

Possible existence of liquids in an anticrystalline structural state .... See Entry 66807

Glass-forming tendency of Pb-containing multicomponent chloride and bromide melts .... See Entry 66879

The effect of magnesium content on the structure and properties of synthetic smectites .... See Entry 66971

Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4 .... See Entry 66974

Radiation-induced crystallinity changes in linear polyethylene .... See Entry 67049

Equation of state for fluid hydrogen-isotopes H_2, D_2, and T_2 up to their freezing points at 300K .... See Entry 67155

A molecular theory for the freezing of hard spheres .... See Entry 67165

Segregation of In and Te in CdSb .... See Entry 67218

Theoretical specific heat consumption in the melting of some commercial glasses. II .... See Entry 67229

Pre-vitrification viscosity enhancement by longitudinal mode coupling .... See Entry 67259

Quantitative evaluation of the interfacial free energies at a solid-liquid lamellar eutectic interface .... See Entry 67315

Electron mobilities and electron-ion recombination rate constants in solid, liquid, and gaseous methane .... See Entry 67593

Electrical properties of glasses and vitroceramics containing MnO_2 .... See Entry 67599

Investigation of the Hall effect in liquid gallium antimonide near the melting point .... See Entry 67660

Instability of the electron-hole plasma in covalent semiconductors .... See Entry 67675

Preparation of TlP_xS_{1-x} and investigation of physicochemical properties .... See Entry 68423

Preparation of strontium tellurite single crystals .... See Entry 68425

Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$ .... See Entry 68433

Growth and thermal stability of γ/γ'-α eutectic composite .... See Entry 68477

Development of the γ-γ'-Cr_3C_2 in-situ composite .... See Entry 68478

In situ composites prepared by solidification and mechanical techniques .... See Entry 68479

Feasibility of directional solidification of lanthanum hexaboride in a boron matrix .... See Entry 68498

Synthesis of alloys and phase diagram of the Cs-Te system .... See Entry 68503

Selective etching and laser melting studies of monotectic composite structures .... See Entry 68510

Investigation of conditions of $TiBiTe_2$ formation .... See Entry 68528

Morphology of primary carbides in niobium-containing variants of M2 high speed steel .... See Entry 68530

Solidification and strength characteristics of Ni-Cr-Ti and Co-Cr-Mo eutectics .... See Entry 68531

In situ electron microscopy: solidification of eutectic alloys .... See Entry 68532

Microstructural perturbations in directionally solidified Al-In, Al-Bi and Zn-Bi monotectic alloys .... See Entry 68533

The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys .... See Entry 68610

The role of solidification rate on fiber distribution and mechanical properties of a directionally solidified nickel base-TaC eutectic .... See Entry 68658

Off-axis mechanical properties of a cellular Al-Al_3Ni directionally solidified eutectic .... See Entry 68659

Vapor pressure in the dissociation of rhenium disulfide as a function of the composition of the compound .... See Entry 68765

Results of investigations of the enthalpies of melting of salt eutectics .... See Entry 68789

64.70F Liquid-vapour transitions

67173 Evaporation of a highly superheated liquid. A.A.Samokhin, A.B.Uspenskii (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.599-605 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.718-24 (July-Aug. 1982). [received: April 1983]
The special features of the surface evaporation of a liquid under the action of a concentrated energy flux are theoretically investigated. It is shown that strong superheating is manifested in a distinctly nonmonotonic behaviour of the evaporation pressure, varying from a curve with a single peak to weakly decaying nonlinear oscillations, depending on the intensity of the acting factor. The peak width and the period of the pressure oscillations depend on the size of the energy-release region. The oscillatory evaporation regime occurs in a relatively narrow range of intensity in which the behavior of the thermophysical parameters of the superheated metastable phase is rather singular. (24 refs.)

67174 Physicochemical properties, critical temperatures, and evaporation enthalpies of alkylalkoxysilanes and arylalkoxysilanes. I.A.Lavygin, I.I.Skorokhodov, O.V.Leitan, Yu.L.Balukov, K.M.Dubinina (State Res. Inst. for Chem. & Technol. of Organometallic Compounds, USSR).
Inorg. Mater. (USA), vol.18, no.5, p.696-700 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.829-34 (May 1982). [received: Feb. 1983]
A systematic study was carried out for the temperature dependence of the density, surface tension, and viscosity of a series of alkyl- and arylalkoxysilanes. An empirical relationship was proposed for calculating the density of these homologous series using the molecular mass and number of carbon atoms in the alkoxy group. A refined value was found for the Si-C_{aryl} bond increment for calculation of the parachor or organosilicon compounds. Critical temperatures and, for some of the compounds, evaporation enthalpies were calculated. The interrelationship of physicochemical properties with the structure of the alkyl and alkoxy groups was examined. The feasibility of describing the temperature dependence of the viscosity of low-molecular-weight organosilicon compounds using the free volume concept was demonstrated. Values were given for constants of the Fulcher-Tamman equation which permit calculation of the viscosity of alkyl- and arylalkoxysilanes in a broad temperature range (down to the glass transition temperature). (6 refs.)

67175 Condensation diagram for thin films of CdS_xTe_{1-x} solid solutions. V.Ya.Vityuk, V.A.Sanitarov, I.P.Kalinkin, N.N.Zapleshko (Lensovet Leningrad Technol. Inst., Leningrad, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.951-4 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1126-9 (July 1982). [received: Feb. 1983]
The phase composition of thin films consisting of CdS_xTe_{1-x} solid solutions on orienting and nonorienting bases is determined by their condensation and decomposition kinetics: at condensation rates greater than the rate of thermoactivated decomposition (at high supersaturations), one-phase films are formed in the entire range of compositions of the CdS-CdTe system. In the opposite case, under condensation conditions closer to equilibrium, a two-phase $\alpha_1+\alpha_2$ film is formed. The condensation diagram was given for CdS_xTe_{1-x} solid solutions on mica. The condensation diagrams of cadmium and zinc sulfotellurides and selenotellurides should have an analogous form. (6 refs.)

67176 Changes in the composition of hyperstoichiometric uranium dioxide during evaporation. Yu.G.Godin, A.N.Bakhteev.
Inorg. Mater. (USA), vol.18, no.7, p.995-8 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1179-83 (July 1982). [received: Feb. 1983]
A method of calculating the rate of evaporation and the rate of change of composition of hyperstoichiometric uranium dioxide during isothermal holding at high temperature in vacuum has been developed. The results of the calculations agree with the experimental data obtained when $UO_{2.0562}$ is evaporated at 1403-1469K. (13 refs.)

67177 Heterogeneous bubble nucleation and conditions for growth in a liquid-gas system of constant mass and volume [bone cell application]. C.A.Ward, W.R.Johnson, R.D.Venter, S.Ho (Dept. of Mech. Engng., Univ. of Toronto, Toronto, Ontario, Canada), T.W.Forest, W.D.Fraser.
J. Appl. Phys. (USA), vol.54, no.4, p.1833-43 (April 1983).
The conditions are considered under which heterogeneous bubble nucleation takes place in a conical pit in the boundary of a constant size volume containing a liquid-gas solution, and the size to which the nucleate bubble grows is predicted. Four possible equilibrium states are found for the nucleate bubble: two unstable, one metastable, and one stable. The unstable state corresponding to the smallest equilibrium size is the one that acts as the threshold size that must be exceeded in the nucleation event. The metastable and second unstable state are encountered as the nucleate bubble emerges from the conical pit and the stable state corresponds to the largest equilibrium size. It arises from the bubble being in a finite volume with fixed mass. The pressure produced in the volume by the growth of the bubble depends on the final state it attains (i.e. either the metastable or stable state). The theoretical expressions obtained from the analysis are applied to predict the conditions under which bubble nucleation and growth take place within a type of bone cell, and the results are used to explain certain types of damage to the bone of animals undergoing decompression from high pressures that have been previously reported in the literature. The expressions are also applied to predict the superheat necessary to produce bubble emergence from a conical pit and are shown to be in agreement with results previously reported. (23 refs.)

67178 Entropy of vaporization at the boiling point. K.Shinoda (Dept. of Appl. Chem., Yokohama Nat. Univ., Yokohama, Japan).
J. Chem. Phys. (USA), vol.78, no.7, p.4784 (1 April 1983).
The empirical relation that the entropy of vaporization at the boiling point is nearly constant for normal liquids, is known as Trouton's rule (1884). In 1915 Hildebrand wrote 'The entropy of vaporization is the same for all normal liquids, not at their boiling points as in Trouton's rule, when vaporized to the same concentration of vapor.' In 1978, Hildebrand said in his monumental address as follows; In the index to the recent book, there are eight references to Trouton's rule, and the value of the 'Trouton constant' is given as 85 ± 10 JK^{-1}. Science advances by discarding its mistakes, such as Ptolemy's epicycles, phlogiston, caloric, lumiferous ether, artiads, and perissads, polywater (and Trouton's rule?). Hildebrand's rule is certainly more accurate than Trouton's rule. But, the boiling point is a preferable temperature for an empirical rule, and the critical pressures of most normal liquids

fall within 50±20 atm, which means that reduced pressure and temperature are nearly constant at respective boiling points. Since vaporization is regarded as solution in vacuum, the entropy of vaporization to the same concentration at the same reduced temperature will be constant for normal liquids. Hence it is preferable to use the concept of the Hildebrand rule to revise Trouton's rule. (9 refs.)

67179 A pseudoatom theory for the liquid-vapor interface of simple metals: computer simulation studies of sodium and cesium. M.P.D'Evelyn, S.A.Rice (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5225-49 (15 April 1983).
The paper describes a theory of the structure of the liquid-vapor interface of simple metal. The atomic motion is described by an effective Hamiltonian for the ions in an inhomogeneous metal. The 'pseudoatom' Hamiltonian is derived by evaluating the electronic free energy of the metal to second order in the electron-ion pseudopotential. The model is completed by an approximate treatment of the metal-nonmetal transition which must occur in the traversal of the liquid-vapor interface. Using the derived effective Hamiltonian, Monte Carlo simulations of liquid sodium and cesium have been carried out. The Monte Carlo algorithm used is much more sophisticated than that employed in conventional simulations of liquids since the effective ion-ion interaction is density and position (relative to the surface) dependent, and therefore must be recalculated with each Monte Carlo displacement to insure convergence to a self-consistent effective Hamiltonian and density distribution. Monte Carlo simulations of bulk liquid sodium and cesium yield pair correlation functions which are in excellent agreement with experimental data. The simulations of the liquid-vapor interface reveal considerable structure, in the form of stable density oscillations extending several atomic layers into the bulk liquid; the spacing characteristic of this structure is about one atomic diameter. (126 refs.)

67180 Nucleate boiling in drag-reducing polymer solutions. D.D.Paul (Battelle-Columbus Labs., Columbus, OH, USA), S.I.Abdel-Khalik.
J. Rheol. (USA), vol.27, no.1, p.59-76 (Feb. 1983).
Nucleate boiling curves for aqueous solutions of drag-reducing polymers have been measured experimentally. The polymers examined are a galactomannan polysaccharide (Galactasol 211), a polyacrylamide (Separan MGL), two polymers consisting of both acrylamide and acrylic acid monomers (Separan NP-10P and Separan AP-30), two polyethylene oxides (Aldrich No. 18202-8 and No. 18946-4), and three hydroxyethyl celluloses (Natrosol 250MR, 250HR, and 250HHR). The boiling curves have been measured using an electrically heated platinum wire submerged in a saturated pool of liquid at atmospheric pressure. Polymer concentration corresponding to relative viscosities of 1.01, 1.04, 1.08, 1.16, and 1.32 have been tested. The observed changes in the nucleate boiling curves for polymer solutions are in qualitative agreement with those predicted by the Rohsenow pool boiling correlation. In particular, the temperature shifts in the boiling curves are predicted adequately based only on how the polymers change the solution surface tension and, more importantly, the solution viscosity. (20 refs.)

Evaluation of binary *PTxy* vapor-liquid equilibrium data for C_6 hydrocarbons. Benzene+cyclohexane ....See Entry 64603

Latent heat and low-temperature heat capacity experiment for the general physics laboratory ....See Entry 64621

Percolation cluster numbers and effective surface tension ....See Entry 64870

An apparatus for the investigation of low-temperature, high-pressure, vapor-liquid and vapor-liquid-liquid equilibria ....See Entry 66449

Asymmetries in evaporation and condensation Knudsen layer problems ....See Entry 66596

The critical points of cubic equations of state for pure fluids ..See Entry 67153

Prediction of thermodynamic properties of normal paraffins using only normal boiling point ....See Entry 67235

64.70H Solid-vapour transitions

67181 Sublimation behavior of molybdenum oxides. Y.Ikeda, H.Ito, T.Mizuno, K.Amioka, G.Matsumoto (Dept. of Nuclear Engng., Nagoya Univ., Nagoya, Japan).
High Temp. Sci. (USA), vol.16, no.1, p.1-22 (Feb. 1983).
The sublimation and decomposition of Mo oxides, such as MoO_2, MoO_3, and Mo_4O_{11}, were studied by high temperature mass spectrometry. Partial pressures of various vapor species including polymeric molecules were reinvestigated for MoO_2 and MoO_3, and newly studied for Mo_4O_{11} by this technique. Heats of reactions over these oxides at measured temperatures T were obtained by the Second Law method and compared with previous data. Estimated thermodynamic functions for the gaseous polymeric species were used to obtain heats of reactions at 298K. For MoO_2 and MoO_3, reasonable partial pressures and heats of reactions for various species were obtained. The heats of sublimation for polymeric $(MoO_3)_2$ and $(MoO_3)_3$ obtained by the Second and Third Law methods at 298K were in good agreement. The vapor species over Mo_4O_{11} were the same as those over MoO_3, but the magnitudes of the various partial pressures were appreciably lower for Mo_4O_{11} than for MoO_3. (19 refs.)

67182 The retarded sublimation of red phosphorus. B.de Largy, A.Finch, P.J.Gardner, N.Kell (Chem. Dept., Royal Holloway Coll., Egham, England).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, no.2, p.383-90 (Feb. 1983).
Vaporization coefficients for red phosphorus (form IV) were determined to the range 620-690K at phosphorus saturation ratios (p^*/p^0) of 0.08-0.29 and in the presence of nitrogen at ca. 1 atm. At 650K, $\alpha_v(p^*/p^0=0.18)=2.5\times10^{-8}$. The effect of iodine on the sublimation rate was examined. (26 refs.)

67183 Vapour pressure measurements on amorphous $Ge_{16}Te_{84}$ alloy by Knudsen cell mass spectrometry. C.Bergman, R.Chastel (Centre de Thermodynamique et de Microcalorimetrie, CNRS, Marseille, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.199-203 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The Knudsen effusion method coupled with a mass spectrometer is a well-known method often employed in metallurgy to study the chemical equilibria in heterogeneous systems. The purpose of this work is to perform measurements of the vapour pressure of tellurium on $Ge_{16}Te_{84}$ amorphous alloys, obtained by liquid quenching. Experiments were performed in the temperature range $370<T/K<650$ yielding the variation of the vapour pressure on the amorphous alloys (T<Tg-410), on the supercooled alloys ($<g<T<T_x$) as well as on the crystalline ones ($T>T_x=500$). At $T/K=400<Tg$, the vapour pressure of tellurium is much higher than over the crystalline sample of the same composition. (16 refs.)

64.70J Liquid-liquid transitions

67184 Thermal expansion and pressure dependence of the critical temperature near the critical solution point of benzonitrile-isooctane. B.C.Miller, E.A.Clerke, S.C.Greer (Univ. of Maryland, College Park, MD, USA).
J. Phys. Chem. (USA), vol.87, no.6, p.1063-6 (17 March 1983).
The authors have measured the mass density as a function of temperature at a near-critical composition in the one-phase region above the upper critical solution point of benzonitrile-isooctane. The measurements indicate a decrease in the density near the critical point and therefore a negative anomaly for the thermal expansion, $\alpha_{p,x}$. This negative anomaly is in agreement with the negative value for the pressure dependence of the critical temperature, dT_c/dP, which has also been determined for this mixture. It is found that $dT_c/dP=-(11.8\pm0.5)\times10^{-8}$ K/Pa. The measurements indicate that this negative anomaly in $\alpha_{p,x}$ will be less than the background positive $\alpha_{p,x}$ until the reduced temperature $(T-T_c)/T_c$ is 2×10^{-13}. (26 refs.)

An apparatus for the investigation of low-temperature, high-pressure, vapor-liquid and vapor-liquid-liquid equilibria ....See Entry 66449

64.70K Solid-solid transitions

(see also 61.50K Crystallographic aspects of polymorphic and order-disorder transformations, 81.30H, 81.30K, 81.30M Microstructures developed by solid-solid phase transformations)

67185 Calorimetric and other studies of phase transitions in solids. H.Chihara (Dept. of Chem., Osaka Univ., Toyonaka, Japan).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.188-93 (March 1983).
Precision calorimetry can provide detailed information about the phase transitions in solids which is utilized to give insight into the nature of transitions and to check the model theories for their validity. Examples of studies are reviewed in this vein on the soft librational mode transition in p-chloranil, the orientational glass transition in carbon monoxide, and the order-disorder transition in hydrogen halides. (28 refs.)

67186 Differential scanning calorimetry (DSC) at pressures up to 5 kbar. Configurational contributions of transition entropies in the plastic crystals cyclohexane and diamantane. R.Sandrock, G.M.Schneider (Lehrstuhl fur Phys. Chem., Univ. Bochum, Bochum, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.197-201 (March 1983).
A method of extrapolating configurational entropies from high pressure DSC data is described. The method allows the separation of configurational entropies from entropy changes due to the volume changes of the transitions. The results on the solid-solid transitions in the plastic crystals cyclohexane and diamantane are discussed with respect to the number of possible molecular orientations. Contrary to literature data rather small numbers are found that can be more easily discussed with consideration of the geometrical parameters of the molecule and the crystal lattice. (19 refs.)

67187 Phase transitions and incommensurability in crystalline model bilayers. R.Kind (Lab. fur Festkorperphys., Eidgenossische Tech. Hochschule, Zurich, Switzerland).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.248-54 (March 1983).
Crystalline layer structure compounds containing aligned aliphatic chains show essentially the same phase transition behaviour as lipid bilayers in liquid systems. This is demonstrated on two representatives of the $(C_nH_{2n+1}NH_3)_2MCl_4$ family ($n=10$, M=Cd and $n=3$, M=Mn) and on one compound of the $C_nH_{2n+1}NH_3Cl$ family ($n=10$). Transitions from completely ordered closely packed structures to disordered states with 'melted' chains, transitions from intercalated to nonintercalated structures, as well as modulated ('ripple') phases can be observed in these model bilayers. A phenomenological description of these transitions is given in the framework of the Landau theory. (19 refs.)

67188 An X-ray diffraction study of lattice compression and phase transition of crystalline phosphorus. T.Kikegawa, H.Iwasaki (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.158-64 (1 April 1983).
Polycrystalline phosphorus has been compressed with sodium chloride as an internal pressure marker in an X-ray diamond-anvil cell. A two-step structural phase transition, orthorhombic→rhombohedral and rhombohedral→simple cubic, has been confirmed. While the rhombohedral (*A*7) structure, found to be common to the Group V*b* elements, forms only in a limited range of pressure, from 5.5 to 10 GPa, the simple cubic (primitive) structure is shown to remain quite stable on compression and no indication of a third transition is detected up to 32 GPa, the highest pressure attained. A least-squares fitting of the lattice-compression data to the Murnaghan equation gives the bulk modulus and its pressure derivative for the three polymorphic phases respectively as follows: 36±2 GPa and 4.5±0.5, 46±4 GPa and 3.0±0.6 and 95±5 GPa and 2.1±0.8. An atomistic model of the first transition between the orthorhombic and rhombohedral structures is proposed and compared with that of the second transition. The stability of the simple cubic structure in the Group V*b* elements under high pressure is discussed. (21 refs.)

67189 Low temperature structural and magnetic properties of $PrPb_3$. M.Niksch, W.Assmus, B.Luthi (Phys. Inst., Univ. Frankfurt Main, Frankfurt, Germany), H.R.Ott.
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.688-98 (1982).
Measurements of elastic constants and thermal expansion on a single-crystal specimen identify the low-temperature phase transition of $PrPb_3$ at 0.37K as a Jahn-Teller type structural transition. Additional neutron-scattering experiments on the same sample confirm the nonmagnetic character of the transition. Large precursor effects in the thermal expansion indicate that structural deformations probably develop at temperatures well above the cooperative transition temperature, a phenomenon which may be a rather general feature of structural phase transitions. (17 refs.)

67190 A new method to determine structural domains. H.Tietze, M.Mullner (Inst. fur Kernphys., Univ. Frankfurt am Main, Frankfurt, Germany), H.Jex.
J. Phys. C (GB), vol.16, no.12, p.2209-16 (30 April 1983).
A new method to determine the volume distribution of structural domains is presented. The scattering intensities of fundamental Bragg reflections are analysed. The theory applies to all phase transitions which exhibit structural domains. Thus, there is a subgroup relation between the low- and high-temperature symmetry. The knowledge of both structures and the temperature-dependent order parameters are required. The method is applied to the structural phase transition of the perovskite $KMnF_3$. (22 refs.)

67191 Polymorphism in organo-metallic bidimensional structures: the bis (n-octylammonium) tetrachlorocadmate. N.B.Chanh, Y.Haget, C.Hauw, A.Meresse, L.Ricard, M.Rey-Lafon (Univ. de Bordeaux, Talence, France).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.589-94 (1983).
Raman spectra, X-ray diffraction diagrams and differential scanning calorimetry show the existence of two structural phase transitions in crystalline $(C_8H_{17}NH_3)_2CdCl_4$. The solid stable at low temperature is ordered, and the alkylammonium chains are in an extended configuration with probably a gauche bond in the proximity of the NH_3 group. The intermediate phase is characterized by a conformational disorder and a modification of the crystalline structure. The number of internal rotations increases in the high temperature form; however, the total transition entropy is lower than the value expected for a total 'melting' of the chains. (15 refs.)

67192 Pressure-induced disproportionation in CuBr. E.F.Skelton, S.B.Qadri, A.W.Webb, R.G.Ingalls, J.M.Traquada (Stanford Synchrotron Radiation Lab., Stanford Univ., Stanford, CA, USA).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.441-3 (4 April 1983).
CuBr has been pressurized to 8.3 GPa in four separate runs. Prima facie evidence of pressure-induced disproportionation of cuprous bromide into cupric bromide has been observed on release of pressure from 7 GPa. Evidence is also seen of a phase change in $CuBr_2$ above 5.5 GPa. (18 refs.)

67193 Dipolar reorientation and order-disorder behaviour of pure and mixed alkali cyanides. F.Luty, J.Oritz-Lopez (Phys. Dept., Univ. of Utah, Salt Lake City, UT, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1289-92 (25 April 1983).
A simple empirical relation connects the critical temperature of the order-disorder transition T_c to the dipolar reorientation rate $\tau^{-1}(T)$ of CN^- molecules by the concept of a critical reorientation rate $\tau_c{}^{-1}(T_c)$. This relation is derived from experimental data on four pure alkali cyanides, the dipole-diluted $(KBr)_{1-x}$:$(KCN)_x$ system, and the mixed alkali cyanides $(KCN)_{1-x}$:$(NaCN)_x$ and $(RbCN)_{1-x}$:$(KCN)_x$. The observed disappearance of the order-disorder transition at a certain x value occurs in all mixed systems, when the spread of relaxation rates exceeds a particular value. (14 refs.)

67194 Density-functional theory applied to phase transformations in transition-metal alloys. J.W.D.Connolly, A.R.Williams (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5169-72 (15 April 1983).
A new theory of cluster expansions has been derived, which allows one, for the first time, to estimate the energy of a disordered system from first principles. The cluster variables are derived from a series of density-functional calculations on ordered compounds. The disordering temperatures calculated with this theory show the correct trends for binary alloys of 4*d* transition metals, and are in excellent agreement with the experimental phase diagrams in most cases. (22 refs.)

67195 X-ray evidence of a structural phase transition in di-tetramethyltetraselenafulvalenium perchlorate [$(TMTSF)_2ClO_4$], pristine and slightly doped. J.P.Pouget, G.Shirane, K.Bechgaard (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France), J.M.Fabre.
Phys. Rev. B (USA), vol.27, no.8, p.5203-6 (15 April 1983).
Diffuse X-ray scattering studies of the quasi-one-dimensional conductor di-tetramethyl-tetraselenafulvalenium perchlorate [$(TMTSF)_2ClO_4$], both in its pristine form and when slightly doped with the sulfur analog tetramethyltetrathiafulvalene (TMTTF), reveal the formation of a low-temperature superstructure, which may involve an ordering of the ClO_4 anions. Superstructure reflections are characterized by the unexpected wave vector $\vec{q}=(0,{}^1/_2,0)$, which might also be stabilized under pressure in the superconducting salts $(TMTSF)_2ReO_4$ and $(TMTSF)_2FSO_3$. The occurrence of a phase transition at 24K in pristine $(TMTSF)_2ClO_4$ provides a clue for the understanding of the dependence on the cooling rate of the electronic ground state of $(TMTSF)_2ClO_4$. (26 refs.)

67196 Low temperature phase diagram of the A15 compounds and the tetragonal-to-tetragonal phase transition of $Nb_2Sn_{1-x}Sb_x$. A.F.Khoder (CENG, Grenoble, France), J.Labbe.
Solid State Commun. (USA), vol.46, no.2, p.91-3 (April 1983).
The recent experimental results obtained by Fujii et al. (1982) and concerning the sign of the tetragonal distortion and the tetragonal-to-tetragonal phase transition (from $\epsilon<0$ to $\epsilon>0$) observed in the A15 pseudobinary alloy $Nb_3Sn_{1-x}Sb_x$ are accounted for by considering the effect of the number of carriers Q on the temperature dependence of the coefficients of the 2nd and 3rd order terms in a Landau type free energy expansion. The calculations carried out with the Labbe-Friedel density of states model enable the authors to draw a low temperature phase diagram which appears to be in good agreement with the existing experimental data for $Nb_3Sn_{1-x}Sb_x$ and V_3Si. (7 refs.)

67197 Unusual sequence of commensurate-incommensurate phase transitions observed in $KLiSO_4$. C.H.A.Fonseca, G.M.Ribeiro, R.Gazzinelli, A.S.Chaves (Dept. de Fisica, Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Solid State Commun. (USA), vol.46, no.3, p.221-5 (April 1983).
An unusual structural phase transition sequence is observed in $KLiSO_4$ by EPR: high temperature prototype phase—incommensurately modulated phase—commensurately modulated phase—incommensurately modulated phase—low temperature prototype phase (reentrant phase). The low temperature phase has the same symmetry $C_6{}^6$ of the high temperature prototype phase. The main feature of the modulation are rotations of the sulphate tetrahedra, which were precisely determined in the commensurately modulated phase. (10 refs.)

67198 A neutron scattering study on the incommensurate-commensurate $\varepsilon\rightarrow\zeta$ phase transiton of the perovskite-type layer compound PAMC: A lock-in phase transition with a flipping modulation vector. W.Depmeier (Univ. de Geneve, Geneve, Switzerland), S.A.Mason.
Solid State Commun. (USA), vol.46, no.5, p.409-12 (May 1983).
An elastic neutron scattering experiment between 80 and 120K has further elucidated the ε- and ζ-phases of PAMC and the $\varepsilon\rightarrow\zeta$ phase transition. The temperature dependence of the incommensurate modulation vector $\mathbf{q}=(1/3+\delta)\mathbf{b}^*$ of the ε-phase has been determined near the phase transition. At the phase transition the modulation vector locks in at $\delta=0$, but below the transiton it flips into the $(\mathbf{b}^*-\mathbf{c}^*)$ direction. The symmetry of ζ-PAMC is monoclinic and the *A*-centering of the normal δ-phase is partially recovered. Multiple and reversible twinning occurs. Pronounced discontinuities appear at the phase transition in the lattice parameters and reflection intensities. (8 refs.)

67199 Diffuse scattering and phase transitions in $RbLiSO_4$ investigated by neutron scattering. F.Frey, H.Jagodzinski (Inst. fur Kristallographie & Mineralogie, Univ. Munchen, Munchen, Germany), A.Pietraszko, C.Zeyen.
Solid State Commun. (USA), vol.46, no.7, p.557-60 (May 1983).
Diffuse scattering as well as the behaviour of satellite scattering within the temperature range of phases I, II and III of $RbLiSO_4$ were studied using elastic and inelastic neutron scattering techniques. The diffuse scattering was found to be of elastic or quasielastic origin from 430 up to 570K. A strong temperature dependence of diffuse and satellite scattering related to the phase transitions was observed. Supposing a truly elastic nature, the intensity profiles were tentatively analysed in terms of a static disorder model. Anomalous inelastic scattering at Λ-points due to a soft mode instability has not been detected so far. (13 refs.)

67200 Static properties of $CsliSO_4$ near the ferroelastic phase transition. A.T.Anistratov, A.V.Zamkov, L.A.Kot, I.N.Stolovitskaya, L.A.Shabanova (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1565-7 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2763-6 (Sept. 1982). [received: April 1983]
The temperature dependence of the birefringence and of the elastic stiffness and compliance constants is measured in the vicinity of the ferroelastic phase transition. A thermodynamic analysis in terms of the Landau theory is carried out. The main characteristics of the thermodynamic potential and the critical exponents are determined. (6 refs.)

67201 . Low-temperature structural transition in strontium tellurite. A.Yu.Kudzin, V.N.Moiseenko, L.Ya.Sadovskaya (State Univ., Dnepropetrovsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1607-8 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2837-9 (Sept. 1982). [received: April 1983]
$SrTeO_3$ has symmetry Cc (the α phase) at room temperature. In the vicinity of 70°C (T_{01}) there is a first-order phase transition with a change of symmetry $Cc\rightarrow C2/c$ (the β phase). The authors study the effect of external variables—the electric field and hydrostatic pressure—on the transition temperature T_{01}. Since the changes in the dielectric constant at the phase transition are small, the determined T_{01} by measuring the conductivity σ of the samples in a constant electric field. (8 refs.)

67202 Order-to-order phase transition in alloys with face-centered superstructures. Z.A.Matysina, E.A.Matysina, D.R.Rizdvyanetskii (Dnepropetrovsk State Univ., Dnepropetrovsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.702-6 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.26-30 (Aug. 1982). [received: April 1983]
The possibility of a temperature phase transition from one superstructure in a binary alloy to a superstructure of another type is theoretically considered. A possible phase diagram for these transitions is constructed. (6 refs.)

Behaviour of the AB_2 type compounds at high pressures and high temperatures .... See Entry 64600

Study of the metamict transformation in α-quartz using high-resolution electron microscopy and convergent beam electron diffraction [nuclear waste] .... See Entry 65434

Molecular motion, defect structures and phase transitions in oligomer crystals .... See Entry 66900

Nucleation and growth of cubic ice in LiCl.n D_2O glasses .... See Entry 66915

Point symmetry of crystals with a triclinic local order parameter .... See Entry 66920

Pressure necessary for polymorphic transitions in pyrochlore structures .... See Entry 66921

High pressure phases in the Mn-Yb system .... See Entry 66930

High temperature equilibria between BCC and $MgCu_2$-type structures in the $Zr_{1-x}M_xW_2$ and $Hf_{1-x}M_xW_2$ ($M\equiv Al,Si$) systems .... See Entry 66932

Powder neutron diffraction study of nickel-titanium martensite .... See Entry 66936

Non-linear model of structures and phase transitions of the SiO_2 crystal family .... See Entry 66938

Orientational disorder of complex cations and anions in high-temperature phases of ionic compounds. Results of three-dimensional electron density calculations on the basis of X-ray diffraction data .... See Entry 66939

X-ray diffraction data from the high pressure phase of AlSb . See Entry 66954

Static and structural properties of III-V zincblende semiconductors .... See Entry 66967

Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4 .... See Entry 66974

X-ray investigation of the high temperature structure of $(CH_3)_3NHCdCl_3$ .... See Entry 66976

Kinetics of strain-induced reorientation of zinc-sulfide and zinc-selenide crystal structures .... See Entry 67097

Hydrogen motion in single-crystal palladium hydride as studied ultrasonically .... See Entry 67117

On diffuse phase transitions and hybrid crystal formation .... See Entry 67159

Kinetics of a unidirectionally inhomogeneous Ising alloy .... See Entry 67160

Irradiation-driven phase transformations in alloys .... See Entry 67161

Cooperative phenomena: a simple model for phase transitions in solid electrolytes .... See Entry 67162

Solubility of In in CdSb .... See Entry 67217

Time-dependent strandlike domains in the charge-density-wave states of $NbSe_3$: An effect not induced by electric field .... See Entry 67228

The heat capacity of single-crystal praseodymium below 1K ... See Entry 67230

Heat capacity anomalies at the commensurate-incommensurate-normal phase transitions in K_2SeO_4-type crystals .... See Entry 67233

Dynamics of ions of the two-dimensional superionic conductor $AgCrS_2$ .... See Entry 67281

Behavior of the activation energy for ionic conduction in $RbAg_4I_5$ near 209K .... See Entry 67282

Charge density anomalies in Si and InSb preceding the high pressure transition .... See Entry 67453

X-ray diffuse scattering study of the organic one-dimensional conductor TMTTF-bromanil .... See Entry 67457

Theory of discommensurations and re-entrant lock-in transition in the charge-density-wave state of $2H-TaSe_2$ .... See Entry 67489

Analytic calculation of the structural properties of semiconductors .... See Entry 67500

Ten years of X-ray diffuse scattering studies of one-dimensional conductors and superconductors .... See Entry 67570

Magnetic and quadrupolar phase transitions in cubic rare-earth intermetallic compounds .... See Entry 67922

Neutron-diffraction study of the structural and magnetic phase transitions in manganese selenide ...... See Entry 67926

ESR study of the normal-incommensurate phase transition in $Sr_2Nb_2O_7$ ...... See Entry 67995

Structural phase transition study of $NiCl_2H_2O$ by EPR ...... See Entry 67996

An ESR study of phase transitions in crystals of $M(BF_4)_2.6H_2O$ (M=Fe, Co, Ni, Zn) ...... See Entry 67997

EPR detection and study of new phase transitions in $Mg(ClO_4)_2.6H_2O$ ...... See Entry 67998

A deuterium NMR study of $D(UO_2XO_4)$, $4D_2O$; X=P, As ...... See Entry 68045

Molecular motion in solid tetraethylammonium halides ...... See Entry 68063

On the order-disorder phase transition of anilinium halides. VI. Phase transition in $4\text{-}RC_6H_4NH_3{}^+X^-$, and $C_6N_5HR'H_2{}^+X^-$, X=Br,I. A $^{79,81}Br$ and ^{127}I NQR study ...... See Entry 68068

High-resolution solid-state nuclear magnetic resonance and X-ray structure study of choline chloride, bromide, and iodide ...... See Entry 68084

Dielectric properties of ammonium fluoroberyllate crystals near phase transitions to an incommensurate phase ...... See Entry 68108

'Four-fold' refringence in quartz ...... See Entry 68170

Raman spectra and structural phase transitions of the perovskite-type layer compounds $RbAlF_4$ and NH_4AlF_4 ...... See Entry 68188

Phase transition and vibrational spectra of l-leucine ...... See Entry 68189

Novel features in the stereochemistry of octacyanides: phase transition in tetra-n-butylammonium octacyanotungstate(V) ...... See Entry 68191

Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine ...... See Entry 68198

Temperature study of infrared reflection spectra on various faces of $MTPP(TCNQ)_2$ single crystals ...... See Entry 68200

A thermal and Raman investigation of the phase transitions above room temperature in anhydrous potassium acetate ...... See Entry 68202

Comment on 'Light scattering study of the phase transition in sym-triazine' [and reply] ...... See Entry 68242

Brillouin spectroscopy in $K_2Ba(NO_2)_4$ ...... See Entry 68251

Preparation of strontium tellurite single crystals ...... See Entry 68425

Study of the SnO_2-Ta_2O_5 system and preparation of tin tantalates and niobates ...... See Entry 68522

The system SrO-Nb_2O_5 ...... See Entry 68525

Phase transformations in ferrosilicon and their influence on inhibitor-phase formation ...... See Entry 68534

Investigation of the kinetics of the polymorphic transition and their influence on the mechanism of sintering of aluminum oxide ...... See Entry 68535

A high-temperature phase transition in $Pb_2Bi_6O_{11}$ ...... See Entry 68536

Variation of electrical resistivity in FeCo alloy on isochronal ordering ...... See Entry 68537

Thermal annealing of doubly oriented nylon 11 in contact with formic acid ...... See Entry 68538

Stress-induced transformations in composite zirconia ceramics ...... See Entry 68539

Volt-ampere characteristics of metastable corona electrodes [martensitic transformation] ...... See Entry 68540

Compositional dependence of transformation temperatures in ternary TiNiAl and TiNiFe alloys ...... See Entry 68541

Microstructural features of charge density wave (CDW) and martensitic transformations in TiNiFe and TiNiAl alloys ...... See Entry 68542

Effect of relaxation of transformation stresses on the martensite points ...... See Entry 68543

On the adiabatic shear of Ti-6Al-4V ballistic targets ...... See Entry 68599

The Bainite transformation and fracture mode of Fe-C-Mn high strength steel containing high carbon ...... See Entry 68629

Wear-resistant cobalt-base alloys ...... See Entry 68660

A dislocation model for the aragonite⇄calcite transition ...... See Entry 69193

64.70M Transitions in liquid crystals

67203 Phase transitions in discotic liquid crystals. [NMR observations]. R.Blinc (J. Stefan Inst., E. Kardelj Univ. of Ljubljana, Ljubljana, Yugoslavia).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.271-4 (March 1983).
The phase diagram of a columnar discotic liquid crystal is evaluated within a Landau theory and the results are compared with the data obtained from ^{13}C NMR measurements on hexapentoxy-triphenylene. (8 refs.)

67204 The polymorphism of 2-n-Nonyl-5-[4-n-butyloxyphenyl]-pyridine. A.Madicke, D.Demus, V.V.Titov, A.I.Pavluchenko, E.I.Kovshev (Sektion Chem., Martin-Luther-Univ. Halle-Wittenberg, Halle, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.K45-7 (1983).
The liquid crystalline polymorphism of 2-n-Nonyl-5-[4-n-butyloxyphenyl]-pyridine was investigated by miscibility experiments. The transition temperature of the substance was determined by means of a polarizing microscope. The smectic modification exhibited a texture with lancets and pseudo π-disclinations. The classification of this smectic modification has been done according to the miscibility criterion. In order to test the behaviour of miscibility in a binary system the diagram of state of a mixture determined by polarized microscopy. (6 refs.)

67205 On the rectangular-hexagonal columnar phase transition in disc-like liquid crystals. C.Destrade, Nguyen Huu Tinh (Centre de Recherche Paul-Pascal, Domaine Univ., Talence, France), J.Malthete, A.M.Levelut.
J. Phys. (France), vol.44, no.5, p.597-602 (May 1983).
The authors report the isobaric binary phase diagram for two disc-like mesogens, hexa-n-octyloxytriphenylene and hexa-n-octanoyloxytriphenylene, which was studied by means of optical texture observations, differential scanning calorimetry and X-ray diffraction measurements. They all confirm the presence of a direct transition between a hexagonal ordered columnar phase and a rectangular disordered columnar phase; this kind of transition is also described in a pure disc-like mesogen: hexa-n-decanoate of truxene. Furthermore, they show, within the binary phase diagram, a strongly non-ideal behaviour with a marked maximum of the spindle between the isotropic and the mesomorphic phase. The existence domain of the hexagonal ordered phase versus temperature and concentration is discussed from a structural point of view. (16 refs.)

67206 Macroscopic dynamics in nematics near the uniaxial-biaxial phase transition. H.Brand (Bell Telephone Labs., Murray Hill, NJ, USA), J.Swift.
J. Phys. Lett. (France), vol.44, no.9, p.L333-7 (1 May 1983).
Based on the derivation of the macroscopic dynamics, the authors present a discussion of possible experiments which probe the macroscopic behaviour of uniaxial nematics close to the transition to the biaxial phase. In particular they propose an experiment to measure the influence of a novel static cross coupling between gradients of the director fluctuations (δn) of the uniaxial phase and the order parameter (ξ_{ij}) of the biaxial phase. (8 refs.)

67207 Glass transition as a function of cooling rate. S.M.Rekhson (General Electric Co., Nela Park, Cleveland, OH, USA), G.W.Scherer.
J. Phys. Colloq. (France), vol.43, no.C-9, p.427-30 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A method is described for calculating structural relaxation in glasses cooled very rapidly. The major obstacle for the calculation was the assumption in the original model of Arrhenius behavior for the equilibrium viscosity. The Macedo-Litovitz hybrid equation is used for the equilibrium viscosity. The glass transition region is shows to shift to higher temperatures and to broaden as the cooling rate increases. Glasses with higher Tg e.g. SiO_2 are shown to have broader glass transition region than glasses with lower T_g but similar activation energy. (5 refs.)

67208 Change in molecular conformation and the nature of the nematic-isotropic-liquid phase transition. E.M.Aver'yanov (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1609-10 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2839-41 (Sept. 1982). [received: April 1983]
The author examines the interaction of the order parameter s with the noncritical conformational degree of freedom of the molecules and analyzes the effect of this interaction on the character of the nematic-isotropic phase transition and on the conformation of the molecules. He examines the mesogenic molecules, for which the conformation of the aromatic framework is characterized by the dihedral angle ϕ between the plane of the π-conjugate fragments. (11 refs.)

67209 On the cholesteric-nematic phase-change transitions in layers with homeotropically orienting surfaces. P.R.Gerber (Central Res. Units, F. Hoffmann-La Roche & Co. Ltd., Basel, Switzerland).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.407-14 (April 1983).
Lattice-model calculations of the energies of surface director-configurations are presented. These configurations mediate between the homeotropic surface conditions and the bulk fingerprint texture of cholesteric layers. Their energy determines the asymptotic behaviour of the cholesteric-nematic threshold field in the limit of thick layers. The dependence of their energies on the elastic constant ratios could be brought into a simple scaling form. This form is in agreement with existing and newly presented measurements. (11 refs.)

Binary smectic mixtures in the infinite dilution limit ...... See Entry 66810

Studies on induced smectic phases. III. Fourier transform infrared and laser-Raman spectral differences between isotropic and induced smectic phase of binary mixtures of nematogens with contrasting dielectric anisotropies ...... See Entry 66811

Dielectric anisotropy in 4-nitrophenyl 4′-octyloxybenzoate ...... See Entry 66816

Molecular field theory of nematics: density functional approach. I. Bulk effects ...... See Entry 66823

Effect of water content on properties of Na_2O3SiO_2 glasses ...... See Entry 66889

64.70P Glass transitions

67210 Glass transition and thermal stability of blends composed of polycarbonate and poly(ethylene terephthalate). M.Mucha (Inst. Polimerow, Politech. Lodzkiej, Lodz, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.27, no.4, p.153-6 (April 1982). In Polish. [received: March 1983]
Dilatometric investigations revealed that blends composed of polycarbonate (Makrolon) and poly(ethylene terephthalate) (Elana) are heterogeneous systems. There exist however interactions of the two components revealed in the changes of the glass transition point, T_g, of both polymers in the blend, their specific heat expansion and thermal stability. The thermogravimetric determinations have shown that blends decompose at a temperature lower than those of both components taken separately and this decomposition is connected with a higher weight loss than that resulting from the additivity of the individual components contribution. This factor can be explained by a negative effect of the products of decomposition of the less stable poly(ethylene terephthalate) on the rate of decomposition of polycarbonate. (16 refs.)

Crystallisation of noncrystalline solids in the system $Li_2B_2O_4$-$LiFe_5O_8$ ...... See Entry 66840

Metallic glasses—some current issues ...... See Entry 66862

Formation, properties and structure of fluoroborate glasses ...... See Entry 66875

Glass-forming tendency of Pb-containing multicomponent chloride and bromide melts ...... See Entry 66879

Crystallization behaviour of gels and gel-monoliths in the Na_2O-B_2O_3-SiO_2 system ...... See Entry 66882

Effect of light on structural relaxation in vitreous selenium thin films ...... See Entry 66885

Physicochemical properties, critical temperatures, and evaporation enthalpies of alkylalkoxysilanes and arylalkoxysilanes ...... See Entry 67174

Calorimetric and other studies of phase transitions in solids ...... See Entry 67185

Thermodynamic relations between the crystallisation of amorphous alloys (Fe,B) and their preparation by hardening from the liquid state ...... See Entry 67240

Pre-vitrification viscosity enhancement by longitudinal mode coupling ...... See Entry 67259

Photon correlation spectroscopy of poly(methyl methacrylate) near the glass transition ...... See Entry 68245

The AsSe-TlSe system ...... See Entry 68517

The $TlAsSe_2$-Se system ...... See Entry 68518

64.75 SOLUBILITY, SEGREGATION, AND MIXING

67211 Stability behaviour of mixed conducting solids after applying electrical potential differences—measurements with point electrodes on Ag_2S and Cu_2S. H.Rickert, H.-D.Wiemhofer (Phys. Chem., Univ. Dortmund, Dortmund, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.236-9 (March 1983).
The decomposition of the mixed conducting low temperature phases of Ag_2S and Cu_2S by applying electrical potential differences between two metal electrodes has been investigated. The experimental method is based on the use of a chemically inert point electrode. It is demonstrated that the electrical resistance of mixed conducting solids measured at point electrodes is a sensitive quantity for the detection of the deposition of components or other phases with different stoichiometry during the decomposition process. The results on Cu_2S and Ag_2S show a large difference in the stability behaviour of the two substances. (14 refs.)

67212 Copper precipitation in long-time diffused silicon. R.Gleichmann, U.Mohr, K.Jegerlehner (Inst. fur Festkorperphys. und Elektronenmikroskopie, Akad. der Wissenschaften, Halle, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.297-305 (1983).
The generation of microdefects in FZ-silicon during long-time high-temperature processing, necessary for the production of power devices, has been investigated by etching techniques and transmission electron microscopy. The results prove the defects to be large precipitates, which may generate dislocations and stacking faults. The analysis of Moire fringes and the interpretation of selected area diffraction patterns indicate the material to be CuSi. The experimental findings are interpreted by the help of an extension of the existing model for the copper precipitation process. (6 refs.)

67213 TEM image contrast from clustering in Ga-In containing III-V alloys. J.P.Gowers (Philips Res. Labs., Redhill, England).
Appl. Phys. A (Germany), vol.A31, no.1, p.23-7 (May 1983).
The fine grainy contrast observed in TEM images of the Ga-In containing III-V alloys GaInP, GaInAs, and GaInAsP is interpreted as direct evidence of alloy clustering. A simple model is proposed in which clustering modulates the average lattice spacing throughout the crystal. For a sinusoidal modulation, solutions of the coupled two-beam dynamical diffraction equations in the column approximation shown large intensity fluctuations when the modulation wavelength is comparable to the extinction distance. (13 refs.)

67214 The solubility of noble gases in water and in NaCl brine. S.P.Smith, B.M.Kennedy (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.503-15 (March 1983).
A direct-sampling, mass-spectrometric technique has been used to measure simultaneously the solubilities of He, Ne, Ar, Kr, and Xe in fresh water and NaCl brine (0 to 5.2 molar) from 0° to 65°C, and at 1 atm total pressure of moist air. The argon solubility in the most concentrated brines is 4 to 7 times less than in fresh water at 65°C and 0°C, respectively. The salt effect is parameterized using the Setschenow equation, $\ln[\beta_0{}^i(T)/\beta^i(T)]=MK_M{}^i(T)$ where M is NaCl molarity, $\beta_0{}^i(T)$ and $\beta^i(T)$ the Bunsen solubility coefficients for gas i in fresh water and brine, and $K_M{}^i(T)$ the empirical salting coefficient. Values of $K_M{}^i(T)$ are calculated using volumetric concentration units for noble gas and NaCl content and are independent of NaCl molarity. The measured solubilities can be used to model noble gas partitioning in two-phase geothermal systems at low temperatures. The data can also be used to estimate the temperature and concentration dependence on the salt effect for other alkali halides. (54 refs.)

67215 Segregation, diffusion, and solubility of Sn in CdSb. D.P.Belotskii, A.F.Semizorov, V.V.Gorbunov, M.K.Makhova (Chernovtsy State Univ., Chernovtsy, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.743-5 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.888-90 (June 1982). [received: Feb. 1983]
The segregation, diffusion, and solubility of tin in cadmium antimonide crystals have been investigated by the labelled-atom technique. The equilibrium coefficients of segregation and the principal diffusion parameters have been determined for the three major crystallographic directions [100], [010], and [001]. The nature of the temperature dependence of tin solubility in the range 150-450°C has been elucidated. (5 refs.)

67216 Solubility of copper in CdSe. A.I.Epik, Yu.A.Varvas (Tallin Polytech. Inst., Tallin, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.757-60 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.904-7 (June 1982). [received: Feb. 1983]
In an investigation of the solubility of copper in CdSe the limits of existence of the main forms of copper in the CdSe-Cu system were determined. In a wide range of values of $p(Se_2)$ and at low p(Cd) the predominant form is Cu_2Se, while the concentration of atomic copper Cu(at) increases with increasing p(Cd). At 1170K and maximum values of p(Cd) the distribution coefficient of copper between CdSe and the alloy Cu_xCd_{1-x} was determined; it was equal to 5.1×10^{-3}, which is evidence of effectiveness of the purification of CdSe from copper by the method of extraction into solution. (10 refs.)

67217 Solubility of In in CdSb. D.P.Belotskii, A.F.Semizorov, V.V.Gorbunov, M.K.Makhova (Chernovitsy State Univ., Chernovitsy, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.1034-5 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1227-9 (July 1982). [received: Feb. 1983]
A portion of the phase diagram is investigated in the range of compositions 0-5 at.% In and the boundary of the region of the solid solution of In in CdSb is determined. Phase transformations in the alloys are investigated by differential thermal analysis. In a study of the solubility of In in CdSb standard methods are used, based on measurements of the microhardness, saturation of the surface of crystalline samples with the radioactive isotope ^{114}In during diffusion annealing, and investigation of the microstructure. The experimental data, obtained on the basis of thermal and microstructural analyses, showed that the range of concentrations 0-5 at.% In of the polythermal section CdSb-In under discussion lies in the region of primary crystallization of CdSb. Below 668K, alloys of the system are three-phase. The final crystallization of the alloys occurs at 548K. These results are in good agreement with previous results. (7 refs.)

67218 Segregation of In and Te in CdSb. A.F.Semizorov, V.V.Gorbunov, D.P.Belotskii (Chernovitsy State Univ., Chernovitsy, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.1036-7 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1229-30 (July 1982). [received: Feb. 1983]
The segregation of donor impurities of In and Te in CdSb have been investigated. Their mobility in liquid CdSb is determined during the flow of a constant electric current through the crystal-melt boundary. The nature of the distribution of impurities along the ingots was determined by the method of labeled atoms. The isotopes ^{114}In and ^{125}Te were used. To find the effective distribution coefficients k of impurities by the method indicated above, crystals with a uniform average composition distribution were used. On the basis of the data of radiometric analysis of the distribution of the isotopes ^{114}In and ^{125}Te along ingots grown at various rates v, the dependences of the effective distribution coefficients on the rate of displacement of the crystallization front were found. (8 refs.)

67219 Comments on 'Scaling theory and enthalpy of mixing for binary fluids' [and reply]. G.Morrison (Thermophys. Div., NBS, Washington, DC, USA), G.ten Brinke, F.E.Karasz.
J. Chem. Phys. (USA), vol.78, no.7, p.4790-2 (1 April 1983).
In a recent note, ten Brinke and Karasz (ibid., vol.77, no.10, p.5249, 1982) have discussed the character of the enthalpy of mixing for binary mixtures near a critical solution temperature (UCST for an upper temperature and LCST for a lower one). They have shown that many of the qualitative features indicated by the classical model of fluids are retained by the scaling model. The real emphasis, Morrison considers, should not fall on the model but on the stability criterion demanded by the second law of thermodynamics, from which the same conclusions can be drawn. ten Brinke and Karasz reply to Morrison's comments. (9 refs.)

67220 Supercritical extraction at atmospheric pressures. I.Procaccia (Dept. of Chem., Weizmann Inst. of Sci., Rehovot, Israel), M.Gitterman.
J. Chem. Phys. (USA), vol.78, no.8, p.5275-6 (15 April 1983).
The authors show theoretically the sharp rise in solubility near the critical point of a binary mixture. In fact the effect should exist in binary mixtures in much the same way as in pure solvents. (11 refs.)

67221 Demixing of micelles of fluorocarbon and hydrocarbon surfactants. Effects of hydrophobic and hydrophilic groups of hydrocarbon surfactants. N.Funasaki, S.Hada.
J. Phys. Chem. (USA), vol.87, no.2, p.342-7 (20 Jan. 1983).
The mutual solubility limits, x_A and x_B, of a nonionic fluorocarbon surfcatant (NFE) and dodecyl polyoxyethylene glycol ether (DE*m*) and of an anionic fluorocarbon surfactant (NF) and sodium alkyl sulfate (SAS) in micelles were determined by the surface tension method as a function of temperature. (31 refs.)

67222 Hydride stability and band structure of the components in the $Pd_{1-x}M_x$ and $LaNi_{5-x}M_x$ systems. R.V.Bucur, D.Lupu (Inst. of Isotopic & Molecular Technol., Cluj-Napoca, Rumania).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.203-9 (April 1983).
The stability of the metal hydrides of $Pd_{1-x}M_x$ and $LaNi_{5-x}M_x$ systems depends strongly on the nature of the substituent M. The change ΔG in free energy on the formation or decomposition of the metal hydrides depends linearly on the average energy $\langle\epsilon_{LB}{}^M\rangle$ of the lowest band of the substituent (transition metal) and on its concentration x. This linear correlation can be expressed by the empirical equation $\Delta G=\Delta G_A+a(\langle\epsilon_{LB}{}^M\rangle-\langle\epsilon_{LB}{}^A\rangle)x$ where ΔG_a is the change in free energy on hydride formation (decomposition) in the pure metal or the intermetallic compound, a is a constant and $\langle\epsilon_{LB}{}^A\rangle$ is the average energy of the lowest band of the component able to bond hydrogen. In dilute palladium alloys (M≡Au, Ag, Pt, Ir, Rh, V, Cu and Ni) at 298K $\Delta G_{Pd}{}^\beta=-2.25$ kcal $(mol\ H_2)^{-1}$ and $\langle\epsilon_{LB}{}^{Pd}\rangle_\beta=-0.68$ rydbergs for the β hydride, and $\Delta G_{Pd}{}^\infty=3.00$ kcal $(mol\ H_2)^{-1}$ and $\langle\epsilon_{LB}{}^{Pd}\rangle_\alpha=-0.63$ rydbergs for the α phase. In the substituted intermetallic $LaNi_{5-x}M_x$ (M≡Pt, Pd, Ag, Fe, Cu, Co and Cr) at 313K $\Delta G(LaNi_5)=0.70$ kcal $(mol\ H_2)^{-1}$, $\langle\epsilon_{LB}(LaNi_5)\rangle=-0.81$ rydbergs and a is a constant that has different values for 3d, 4d and 5d transition metals. The dependence of ΔG on the band structure of the components (transition metals) is discussed within the framework of the metal-hydrogen bonding mechanism in metal hydrides. (17 refs.)

67223 On the construction of a statistical model for primary solid solutions of hydrogen in the group Va transition metals (vanadium, niobium and tantalum). N.Shohoji (Dept. de Metalurgia e Metalomecanica, Lab. Nacional de Engenharia e Tecnologica Industrial, Sacavem, Portugal).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L27-9 (April 1983).
Demonstrates the significance of the choice of the number of available sites for H per M atom in the construction of statistical models. The H_2 pressure composition-temperature relations for primary solid solutions of H in Ta, Nb, and V are used as examples. (9 refs.)

67224 Behaviour of germanium in phase separable glasses of the system Na_2O-B_2O_3-GeO_2-SiO_2. F.Gauthier, C.Lapeyre, J.Gombert (Thomson-CSF, Orsay, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.253-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The role of GeO_2 in the Na_2O-B_2O_3-GeO_2-SiO_2 quaternary system which presents a spinodal decomposition domain is studied. The physical properties of this system are compared to those of the system without GeO_2. The leaching conditions of these glasses and the coordination of Ge are studied. (5 refs.)

67225 Enthalpies of mixing of ternary systems. III. The system In-Sn-Te. B.Gather, R.Blachnik (Anorganische Chem., Univ.-Gesamthochschule, Siegen, Germany).
Z. Metallkd. (Germany), vol.74, no.4, p.212-15 (April 1983).
For pt.II see ibid., vol.73, p.245 (1982). The enthalpies of mixing of the ternary system In-Sn-Te were determined in a heat flow calorimeter at 1020K. The experimental data are presented in a graph of isoenthalpic lines. These results are compared with ternary enthalpies calculated from the enthalpy data of the three binary systems. The calculations show a ternary excess enthalpy. (12 refs.)

67226 Solid solubility and precipitation of phosphorus and arsenic in silicon solar cells front layer. D.Nobili (CNR, Istituto Lamel, Bologna, Italy).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.410-20
The physical nature of the electrically inactive P and As in silicon is discussed, and the results of experiments performed on specimens doped in a wide range of concentration obtained by ion implantation and laser annealing are reported. Thermal treatments of these alloys provided solid solubility values which correspond to the carrier density in equilibrium with excess dopant. Additional confirmation that the electrically inactive phosphorus and arsenic are a precipitated phase was obtained by the kinetics of the annealing

process. The occurrence of precipitation in an amount consistent with that of the inactive phosphorus was confirmed by TEM examinations using the weak beam dark field (WBDF) technique. The precipitation of arsenic was detected by small angle X-ray scattering (SAXS) which provided also details on the size and shape of the particles. These results clearly contradict the well known models developed to account for the difference between carrier and chemical concentration profiles of P and As. These models hypothesize the formation of a high equilibrium concentration of complex point defects which compensate or make the excess dopant electrically inactive. As a consequence the models for the diffusion of P and As based on the above mentioned hypothesis are also contradicted. The influence of these precipitates on the minority carrier lifetime in the n^+ emitter region and on the conversion efficiency of silicon solar cells is considered, with reference to experimental procedures which reduce the amount of inactive dopant. (36 refs.)

Evaluation of binary excess enthalpy data for C_6 hydrocarbons. Benzene+cyclohexane ... See Entry 64604

A simple theory to predict small changes in volume and refractivity during mixing of a two-component liquid system ... See Entry 64636

Construction of lines of constant density and constant refractive index for ternary liquid mixtures ... See Entry 64637

The dissolution of irradiated fuel under hydrothermal conditions ... See Entry 65391

Conditions for the preparation and subsequent crystallization of amorphous alloys of the Ge-Te system ... See Entry 66832

SAXS and TEM studies of phase separation in $BaO-SiO_2$ glasses ... See Entry 66870

An investigation of relationship between phase separation and crystallization of $ZnO-Al_2O_3-SiO_2$ glasses ... See Entry 66877

Kinetics of crystal growth under conditions of low solubility of a crystal-forming substance in a matrix ... See Entry 66910

High temperature equilibria between BCC and $MgCu_2$-type structures in the $Zr_{1-x}M_xW_2$ and $Hf_{1-x}M_xW_2$ (M≡Al,Si) systems ... See Entry 66932

Segregation of solute atoms at dislocations in low-angle grain boundaries ... See Entry 67009

Comparison between natural and synthetic grain boundaries by means of discontinuous precipitation ... See Entry 67011

A correlation between tetrahedral radius and solid solubility of group III, IV and V impurities in germanium ... See Entry 67013

Colling rate dependence of the icer I nucleation temperature in aqueous LiCl solutions ... See Entry 67171

Condensation diagram for thin films of CdS_xTe_{1-x} solid solutions ... See Entry 67175

Heterogeneous bubble nucleation and conditions for growth in a liquid-gas system of constant mass and volume [bone cell application] ... See Entry 67177

Stoichiometric limits of carbon-rich boron carbide phases ... See Entry 67227

Stability and reactivity of (001) and (111) NiO: a RHEED-AES investigation of Si surface segregation and Ni formation by gas reduction ... See Entry 67326

A LEIS study of potassium enriched vanadium oxide surfaces ... See Entry 67329

Epitaxial growth of tungsten and tungsten-rhenium alloys from the gas phase ... See Entry 67389

Concentration and temperature dependence of the electrical resistivity of quenched PdH_x ... See Entry 67559

Temperature dependence of the Hall coefficient of CuBe2 between 6 and 300K ... See Entry 67566

Surface properties of tin dioxide single crystals ... See Entry 67753

^1H NMR study of the phase separation and the behavior of hydrogen in $Ti_{1-y}V_yH_x$ ... See Entry 68071

Raman and visible-ultraviolet spectra of polyhalide anions in molten I_2/KI-LiI, I_2/CsCl-LiCl, and I_2-ICl/CsCl-LiCl ... See Entry 68199

Evaluation of the spin-up time during the accelerated crucible rotation technique ... See Entry 68418

The effect of thermal treatment on microstructure of nickel base PM superalloys ... See Entry 68475

Growth and thermal stability of γ/γ'-α eutectic composite ... See Entry 68477

Preparation of a Ni-Zn ferrite from a submicronic grain size powder ... See Entry 68484

Isotopic effects in hydrogen-intermetallic compounds systems ... See Entry 68505

Solid-liquid-equilibria in the α-range of copper-antimony alloys ... See Entry 68506

Thermodynamic properties of binary alloys of platinum metals. III. Iridium-rhodium ... See Entry 68507

Interaction in $Ga_2S_3-Y_2O_3$ and $In_2S_3-Y_2O_3$ systems ... See Entry 68521

Interaction in the $Bi_2Te_3-La_3Te_4$ system ... See Entry 68523

Morphology of primary carbides in niobium-containing variants of M2 high speed steel ... See Entry 68530

Analytical investigation of the precipitation of nitrides in steel ... See Entry 68544

On the structure of α'_m-precipitates in Al-Zn alloys ... See Entry 68545

X-ray diffraction quantitative analysis of the Heusler alloy $CU_{2.00}Mn_{1.00}Al_{1.00}$ annealed at temperatures between 423 and 973K ... See Entry 68546

A study of precipitation in AISI type 316 stainless steel ... See Entry 68547

On the influence of impurity additions and quenching temperature on the course of the microhardness (HV) during a two-step ageing treatment of an Al-2.0 at.% Zn-1.3 at.% Mg alloy ... See Entry 68567

Intergranular fracture of high purity iron due to oxygen ... See Entry 68626

The Bainite transformation and fracture mode of Fe-C-Mn high strength steel containing high carbon ... See Entry 68629

Precipitation induced embrittlement after thermal exposure of high-manganese, austenitic retaining-ring steels ... See Entry 68648

Relevance of microstructure to stress corrosion cracking in Al-5% Zn and Al-5% Cu alloys containing titanium ... See Entry 68696

Heat capacities of solution for alcohols in polar solvents and the new view of hydrophobic effects ... See Entry 68790

A method of calculating quartz solubilities in aqueous sodium chloride solutions ... See Entry 69147

Calculation of amorphous silica solubilities at 25° to 300°C and apparent cation hydration numbers in aqueous salt solutions using the concept of effective density of water ... See Entry 69148

64.80 OTHER PHASE PROPERTIES OF SYSTEMS

67227 **Stoichiometric limits of carbon-rich boron carbide phases.** M.Beauvy (Dept. de Technol., CENS, Gif sur Yvette, France).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.169-75 (April 1983).
The stoichiometric boron-to-carbon ratios of various carbon-rich boron carbide phases were investigated. Many powders or sintered pellets were analysed and the total boron, total carbon, free-boron and free-carbon concentrations were measured for each specimen before calculating the stoichiometric ratio. The methods described were applied to a large number of analyses and the standard deviation of the results was evaluated. The stoichiometric boron-to-carbon ratio for carbon-rich boron carbide phases was found to depend on the synthesis conditions. Boron dissolves up to 21.6 at.% C at low temperatures and up to 24.3 at.% C near the melting point. Free carbon is deposited as the result of a solid state phase transformation. The stoichiometry of boron carbide prepared by the magnetothermal reaction is $B_{3.63}C$ (approximately $B_{11}C_3$). Boron carbide produced by arc melting boron oxide and carbon is a solid solution. This single carbide melts congruently at a temperature of approximately 2450°C with a carbon content of 18.4 at.% ($B_{4.45}C$). (29 refs.)

67228 **Time-dependent strandlike domains in the charge-density-wave states of $NbSe_3$: An effect not induced by electric field.** C.H.Chen, R.M.Fleming, P.M.Petroff (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4459-62 (1 April 1983).
The authors have made observations of the strandlike domains associated with the charge-density-wave phase transitions in $NbSe_3$ with electric fields applied along the *b* axis of the crystal. No electric-field-induced changes of the standlike domains were observed suggesting that the time-dependent images observed in $NbSe_3$ by dark-field electron microscopy [K.K. Fung and J.W. Steeds, Phys. Rev. Lett. 45, 1696 (1980)] do not originate from the depinning of charge-density waves by electric fields. The authors note that the time-dependent images are found only in a minority of the samples that they have examined. The origin of the strandlike domains and its time-dependent effect in $NbSe_3$ remains obscure at present despite the thorough understanding of the domain structures of incommensurate charge-density waves in other systems such as $2H$-$TaSe_2$. (12 refs.)

Site occupancies and stoichiometries in hydrides of intermetallic compounds: geometric considerations ... See Entry 66933

Stoichiometry effects at NiMo surfaces under bombardment with Ar^+ ions from 40 to 2000 eV ... See Entry 67062

Solubility of In in CdSb ... See Entry 67217

Equations for temperature-concentration function of enthalpy and heat capacity of niobium carbide in the homogeneity region ... See Entry 67237

Microstructural features of Zircaloy-2 and stainless steel AISI-304 L electron beam joint ... See Entry 67376

Condensed layers of molybdenum and tungsten silicides ... See Entry 67388

Investigation of deviations from stoichiometry in copper selenide by the method of nuclear magnetic resonance ... See Entry 68039

Optical properties of codeposited aluminum-silicon composite films ... See Entry 68338

Preparation of TlP_xS_{1-x} and investigation of physicochemical properties ... See Entry 68423

Microstructure and mechanisms for recrystallization in polycrystalline PbTe samples ... See Entry 68431

Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$ ... See Entry 68433

Section of the phase diagram of the In_2Te_3-Fe system in the vicinity of In_2Te_3 and thermodynamic investigation of nonionized impurity atoms in crystals with stoichiometric vacancies ... See Entry 68519

Interaction in the $Bi_2Te_3-La_3Te_4$ system ... See Entry 68523

X-ray study of fine structure of $Si-ZrSi_2$ eutectic obtained by oriented crystallization ... See Entry 68548

Properties of polycrystalline indium oxide in the air and in vacuum ... See Entry 68568

65.00 THERMAL PROPERTIES OF CONDENSED MATTER

(see also 05.70 Thermodynamics, 63. Lattice dynamics; for thermal conduction in nonmetallic liquids, see 66.60; for thermal conduction in nonmetallic solids, see 66.70; for electronic thermal conduction, see 72.15, 72.20 and 74.30E; for thermodynamic properties of quantum fluids, see 67.40, 67.50, and 67.60; for thermal properties of solid helium, see 67.80)

65.20 HEAT CAPACITIES OF LIQUIDS

67229 **Theoretical specific heat consumption in the melting of some commercial glasses. II.** L.Kosa (Inst. of Inorganic Chem., Slovak Acad. of Sci., Bratislava, Czechoslovakia), K.Kazda, M.Kriz, I.Proks.
Silikaty (Czechoslovakia), vol.27, no.1, p.31-8 (1983). In Czech.
For pt.I see ibid., vol.26, p.327 (1982). The method described in Part I was used to determine the temperature dependence of theoretical specific heat Δh_{melt} required for the melting of alkali-free borosilicate glass, alkali borosilicate glass, crystal glass and lead crystal from dry batch. Equations are related to the temperature dependence of Δh_{melt} of white container glass and temperature dependences of Δh_{melt} of these glasses (in the same order) melted from moist batch. The temperature interval of its validity is specified for each equation. (8 refs.)

Latent heat and low-temperature heat capacity experiment for the general physics laboratory ... See Entry 64621

65.40 HEAT CAPACITIES OF SOLIDS

for specific heat of superconductors, see 74.30E; for specific heat of magnetic systems, see 75.40

67230 The heat capacity of single-crystal praseodymium below 1K. M.Eriksen, E.M.Forgan, C.M.Muirhead, R.C.Young (Dept. of Phys., Univ. of Birmingham, Birmingham, England).
J. Phys. F (GB), vol.13, no.5, p.929-44 (May 1983).
The heat capacity of a single crystal of Pr of high purity (residual resistance ratio 140-150) has been measured from 1K to 20 mK, including measurements with a magnetic field of up to 1 T along [1010]. The principal contributions are an electronic term ($\gamma=20\pm1$ mJ mol^{-1} K^{-2}) and a hyperfine term which in zero field exhibits a second-order phase transition with a critical temperature of 42 ± 2 mK. The application of a field reduces T_c and introduces a large contribution in the region $T>T_c$. The induced atomic moment calculated from these results is in good agreement with the results of neutron diffraction studies below 1K. Calculations have been made of the heat capacity expected from applying the mean-field approximation to the Murao model of a nuclear-induced magnetic phase transition. There is good agreement with experiment both for zero field and in applied fields. The results are consistent with ordering only on hexagonal sites and give the value of the peak ionic exchange interaction to be 90% of critical ($\mu=0.90$). The sizes have been estimated of the pseudo-quadrupole contribution, which is too small to have any substantial effect, and the fluctuation contribution to the heat capacity for $T>T_c$, which is much smaller than the authors observe. (20 refs.)

67231 Heat capacity and medium range order in oxide glasses. N.Soga (Dept. of Industrial Chem., Kyoto Univ., Kyoto, Japan).
J. Phys. Colloq. (France), vol.43, no.C-9, p.557-68 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The three-band theory using three characteristic temperatures θ_E, θ_1 and θ_3 has been applied to analyze the existing and new data of low temperature heat capacity of various silicates, borates and germanates in both glassy and crystalline states. The values of θ_E for various modifying cations in glasses were similar to those in crystals. The change in coordination state or short range order of network forming cations was observable in θ_1. The values of θ_3 for some glasses were considerably smaller than those of comparable crystals. These data were used to discuss the randomness or medium range order in glass structure. Furthermore, the applicability of the results to interpret the elastic behavior of glass was presented. (40 refs.)

67232 Calculation of the phonon contribution to the specific heat of an overlayer-film substrate at low temperatures. P.Masri (Lab. d'Etudes des Surfaces, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Solid State Commun. (USA), vol.46, no.7, p.563-7 (May 1983).
Using the Green function method, the author calculates the vibrational specific heat C_v produced by an overlayer-film substrate interface at low temperatures. A variation as T^2 is found and the dependence of C_v upon the film thickness is determined analytically. (8 refs.)

67233 Heat capacity anomalies at the commensurate-incommensurate-normal phase transitions in K_2SeO_4-type crystals. T.Atake.
Solid State Phys. (Japan), vol.18, no.1, p.13-20 (Jan. 1983). In Japanese.
Calorimetric studies on K_2SeO_4, Rb_2ZnCl_4 and Rb_2ZnBr_4 are reviewed with the emphasis on the incommensurate structures, which are well explained by a Landau-type phenomenological theory. (57 refs.)

67234 Determination of the temperature dependence of molar thermal capacity C_m (T, p_{atm}) of $LaNbO_4$. V.B.Glushkova, T.I.Panova (Inst. Chem. Silicates im. I.V.Grebenshchikova, Acad. of Sci., Leningrad, USSR), M.Eliasova, I.Proks.
Silikaty (Czechoslovakia), vol.27, no.1, p.69-72 (1983). In Czech.
On the basis of calorimetrically measured values of molar enthalpy increments $\Delta H_{m,tem}(T,p_{atm})=H_m(T,p_{atm})-H_m(298\ K,p_{atm})$ the temperature dependence of molar thermal capacity of tetragonal lanthanum niobate $LaNbO_4$ was determined within the temperature interval 1592-[illegible] K. The specimen of $LaNbO_4$ was prepared by ignition of niobium and lanthanum hydroxides (maximum temperature 1400°C). The temperature dependence of $\Delta H_{m,tem}(T,p_{atm})$ of the compound was calculated from experimental values. The estimate of standard deviation of the $\Delta H_{m,tem}(T,p_{atm})$ values was $s=2.2$ kJ mol^{-1}. The estimated errors of coefficients a and b: $s(a)=4.0\times10^{-3}$ kJ mole^{-1}K^{-1} and $s(b)=2.8\times10^{-6}$ kJ mole^{-1}K^{-2}. The temperature dependence of molar thermal capacity is given by the equation $C_m(T,p_{atm})=a+bT$ where $a=103.1$ J mole^{-1}K^{-1} and $b=5.06\times10^{-2}$ J mole^{-1}K^{-2}. The results of experimental determination of molar thermal capacity $C_m(T,p_{atm})$ of $LaNbO_4$ according to the present study have contributed to the verification of the method by Landiya (1962) for the calculation of this magnitude. The agreement between the results was satisfactory. (4 refs.)

Heat capacity and other thermodynamic properties of linear macromolecules. VI. Acrylic polymers .... See Entry 64601

Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4 .... See Entry 66974

Elastic anisotropy and phonon dispersion effects in iron and tungsten .... See Entry [illegible]

Lattice dynamics of black phosphorus .... See Entry [illegible]

Glass transition and thermal stability of blends composed of polycarbonate and polyethylene terephthalate .... See Entry [illegible]

High-temperature enthalpy and heat capacity of calcium zirconate .... See Entry 67236

Equations for temperature-concentration function of enthalpy and heat capacity of niobium carbide in the homogeneity region .... See Entry 67237

The nature of the superconducting state in PbTe doped with thallium .... See Entry 67342

65.50 THERMODYNAMIC PROPERTIES AND ENTROPY

67235 Prediction of thermodynamic properties of normal paraffins using only normal boiling point. C.H.Twu (Process Simulation Internat., Fullerton, CA, USA).
Fluid Phase Equilibria (Netherlands), vol.11, no.1, p.65-81 (April 1983).
The main objective of this work is to develop a generalized equation of state for normal alkanes from only the normal boiling point. Since the equation of state for normal alkanes is found to be a function only of normal boiling-point temperature, the new correlation should be very useful for correlating departures of other systems from normal-alkane behavior using a normal alkane as a nonspherical reference. The equation of state represents accurately the vapor pressures, densities and enthalpy departures of the vapor, liquid and fluid states as a function only of boiling-point temperature over the entire range of interest for the normal paraffins methane (CH_4) through *n*-hectane ($C_{100}H_{202}$). (44 refs.)

67236 High-temperature enthalpy and heat capacity of calcium zirconate. G.G.Gvelesiani, D.Sh.Tsagareishvili, I.S.Omiadze (Inst. of Metal., Acad. of Sci., Georgian SSR), V.A.Levitskii, P.B.Narchuk.
Inorg. Mater. (USA), vol.18, no.6, p.833-7 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.991-5 (June 1982). [received: Feb. 1983]
A mixing calorimetric method has been used to investigate the enthalpy $H_T-H_{298.15}$, the mean heat capacity $\bar{c}_p$ and the true heat capacity c_p of calcium zirconate $CaZrO_3$ at 298.15-1500 °K. The least squares method has been used to construct interpolation equations for the temperature dependences of these thermodynamic functions. These results have been compared with the literature data. (19 refs.)

67237 Equations for temperature-concentration function of enthalpy and heat capacity of niobium carbide in the homogeneity region. A.G.Turchanin (Kramatorsk Industrial Inst., Kramatorsk, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.962-4 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1140-2 (July 1982). [received: Feb. 1983]
A method has been proposed for experimental data processing whereby equations have been obtained for temperature-concentration functions of enthalpy and heat capacity of niobium carbide; the equations make it possible to determine these functions for carbides of any composition in the homogeneity region at 1300-2200K. In the case of the carbides rich in carbon (from the composition $NbC_{0.9}$ to $NbC_{1.0}$), the equations can be used for calculating enthalpy and heat capacity at 1300-2500K. (11 refs.)

67238 Corrected Debye-Huckel theory of electrolyte solutions. S.Nordholm (Dept. of Phys. Chem., Chalmers Univ. of Technol., Goteborg, Sweden).
J. Chem. Phys. (USA), vol.78, no.9, p.5759-63 (1 May 1983).
A simple correction for the finite size of the ions in the atmosphere is introduced into the Debye-Huckel theory. The main effect is to decrease the repulsion among the counterions and thus increase κ. The internal energy, osmotic coefficient, and activity coefficient in the restricted primitive model are found to agree with simulation results for 1-1 and 2-2 electrolytes qualitatively and often to nearly quantitative accuracy. (21 refs.)

67239 Thermodynamic properties of a square-well fluid in the liquid and vapor regions. D.D.Carley (Dept. of Phys., Western Michigan Univ., Kalamazoo, MI, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5776-81 (1 May 1983).
The thermodynamic properties of a square-well fluid are computed for temperatures below the critical temperature using a perturbation technique. Thermodynamic functions such as pressure, internal energy, and the Helmholtz function are evaluated and compared with computer simulation results. The critical point is found and the liquid-vapor phase diagram is obtained. The perturbation method uses high temperature parametric integral equation results as an original reference system and applied first order perturbation theory to the Helmholtz function. The pair potential (ϕ) is written as the sum of two parts, a reference potential (ϕ_r) and a perturbing potential (ϕ_p) and the separation is established by the relationship $\phi_r=\alpha\phi$ where α is a constant. This separation leads up to a particularly simple method of computing thermodynamic properties when the pressure and internal energy are known along one isotherm. In the case of the square-well potential this approximation leads not only to simple equations but the results also appear to be reasonably accurate. (6 refs.)

67240 Thermodynamic relations between the crystallisation of amorphous alloys (Fe,B) and their preparation by hardening from the liquid state. C.Cunat, J.Charles, J.Hertz, J.M.Dubois, G.Le Caer (Lab. de Thermodynamique Metall., Univ. de Nancy I, Vandoeuvre-les-Nancy, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.191-7 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
This experimental study is based on the enthalpic analysis of the crystallization of fourteen $Fe(1-x)$ Bx amorphous alloys with $0.125\leq x\leq0.25$. The authors show that this system, though it is out of equilibrium, exhibits characteristics of thermodynamic reversibility. They point out the existence of a biphased domain formed from the undercooled liquid during the glass transition. They calculate the free enthalpy of the liquid from data of the phase diagram and from some thermodynamic properties of the solid phases. In order to account for their observations, they propose a simplified model of associations in the liquid phase. (13 refs.)

67241 Electrochemical study of Ti in bromide melts. Peng Ruiwu, Ren Yaocheng (Shanghai Inst. of Metallurgy, Acad. Sinica, Shanghai, China).
Kexue Tongbao Foreign Lang. Ed. (China), vol.27, no.12, p.1292-8 (Dec. 1982).
Bromide melts may be one of the promising salts for the preparation, refinement and regrowth of high melting-point metals and for studying the nature of molten salts. The author presents the electrode potentials of Ti and the equilibrium between Ti^0-Ti^{+2}-Ti^{+3} in bromide melts, with a view to investigating the electrochemical and thermodynamic properties of Ti in alkali bromide melts. (7 refs.)

Heat capacity and other thermodynamic properties of linear macromolecules. VI. Acrylic polymers .... See Entry 64601

Evaluation of binary excess enthalpy data for C_6 hydrocarbons. Benzene−cyclohexane .... See Entry 64604

Evaluation of binary excess volume data for C_6 hydrocarbons. Benzene−cyclohexane .... See Entry 64605

Gibbs' principle and thermodynamic inequalities for nonlinear-elastic bodies .... See Entry [illegible]

Thermodynamic perturbation theory for molecular liquid mixtures .... See Entry [illegible]

A statistical theory of the Collins' model in the phase transition of two-dimensional system .... See Entry 67157

Computer coupling of phase diagrams and thermodynamics .... See Entry 67158

Sublimation behavior of molybdenum oxides .... See Entry 67181

Differential scanning calorimetry (DSC) at pressures up to 5 kbar. Configurational contributions of transition entropies in the plastic crystals cyclohexane and [illegible] .... See Entry [illegible]

Hydride stability and band structure of the components in the $Pd_{1-x}M_x$ and $LaNi_{5-x}M_x$ systems .... See Entry 67222

Determination of the temperature dependence of molar thermal capacity C_m (T, p_{atm}) of $LaNbO_4$ .... See Entry 67234

The contribution of hydrogen bonds to the surface tension of water .... See Entry 67308

Quantitative evaluation of the interfacial free energies at a solid-liquid lamellar eutectic interface .... See Entry 67315

Theory of order-disorder transitions for inhomogeneous mixed-valence systems .... See Entry 67546

Temperature study of infrared reflection spectra on various faces of MTPP(TCNQ)$_2$ single crystals .... See Entry 68200

Thermodynamic treatment of chemiluminescence efficiency .... See Entry 68337

Thermodynamic properties of binary alloys of platinum metals. III. Iridium-rhodium .... See Entry 68507

Quaternary interacting $A^{II}B^{VI}$ semiconductor systems .... See Entry 68520

Estimation of free energy of formation of $Mg_3V_2O_8$ between 298 and 1200K .... See Entry 68788

Results of investigations of the enthalpies of melting of salt eutectics .... See Entry 68789

Variational model for micelle structure .... See Entry 68806

65.70 THERMAL EXPANSION AND THERMOMECHANICAL EFFECTS

(see also 64.30 Equations of state; for electronic thermal conduction, see 72.15 and 72.20; for thermal conductivity of superconductors, see 74.30E; for pyroelectric and electroealoric effects, see 77.70)

67242 **Dependence of the thermal-expansion coefficients of oxide coatings on the properties of their component ions.** L.A.Shvartsman, V.G.Borisenko (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.85-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.714-15 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
The ionic structure of systems which contain acidic and basic oxides and are capable of vitrification is considered. The relation between the apparent molar refraction of oxygen ions in oxide systems and the thermal-expansion coefficient of the coating is noted. (8 refs.)

67243 **Thermal expansion of yttrium vanadate.** N.Rajashekhar Reddy, K.Satyanarayana Murthy (Dept. of Phys., Univ. Coll. of Sci., Calcutta, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.139-40 (April 1983).
The authors have studied the lattice thermal behaviour of yttrium vanadate (YVO_4) at high temperatures. The precision lattice parameters and the coefficients of thermal expansion of YVO_4 are presented. (7 refs.)

67244 **X-ray determination of the thermal expansion of Ti_3Au.** M.S.Reddy, J.Sadanandam, S.V.Suryanarayana (Dept. of Phys., Univ. Coll. of Science, Calcutta, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.166-8 (April 1983).
The authors report their data on the lattice parameters and thermal expansion of the A15 superconductor Ti_3Au between room temperature and 510°C. (21 refs.)

67245 **Lattice thermal expansion of silver metaperiodate.** J.Sadanandam, V.Deshpande, S.V.Suryanarayana (Dept. of Phys., Univ. Coll. of Sci., Calcutta, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.169-70 (April 1983).
The authors describe the results of precision lattice parameter and thermal expansion experiments on $AgIO_4$ and isotype of scheelite in the high temperature range between room temperature and 150°C. (19 refs.)

67246 **Lattice thermal expansion of Nb_3Os.** M.S.Reddy, S.V.Suryanarayana (Dept. of Phys., Univ. Coll. of Sci., Calcutta, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.171-2 (April 1983).
The authors present the results obtained on the precision lattice parameter and thermal expansion of Nb_3Os using X-ray diffraction methods. (12 refs.)

67247 **Thermal expansion of rolled and extruded uranium.** R.W.Logan, D.H.Wood (Materials Sci. Div., Lawrence Livermore Nat. Lab., Livermore, CA, USA).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.233-41 (April 1983).
Reports the results of studies of the thermal expansion characteristics of hot- and warm-rolled α-U plate and hot-extruded pipe. The hot-rolled plate had a high coefficient of thermal expansion (CTE) in the rolling direction and a low CTE in the transverse direction. This trend was reversed in both as-warm-rolled plate and plate that was both warm rolled and annealed. In pipe that was hot extruded at large reduction ratios, the authors were able to correlate the CTE for the extrusion, radial and circumferential directions with the CTE for rolling, transverse and normal directions in the hot-rolled plate. (19 refs.)

67248 **Thermal expansion of oriented poly(methyl methacrylate).** L.-H.Wang, C.L.Choy, R.S.Porter (Polymer Sci. & Engng. Dept., Univ. of Massachusetts, Amherst, MA, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.657-65 (April 1983).
The thermal expansivities along ($\alpha_\parallel$) and perpendicular ($\alpha_\perp$) to the draw direction of poly(methyl methacrylate) (PMMA) with extrusion draw ratios $1 \leq \lambda \leq 4$ have been measured between 150 and 298K. As λ was increased from 1 to 4, $\alpha_\parallel$ decreased 2-3 times, whereas $\alpha_\perp$ increased only 20-35%. The orientation function f calculated from thermal expansivity using the aggregate model is found to change linearly with birefringence, indicating that each property provides a sensitive measure of molecular orientation. For PMMA, however, only thermal expansivity can give an absolute f, with results at 150K in reasonable agreement with previous studies using other techniques. At higher temperature, i.e. above ambient, PMMA side-group motions are excited, expanding volume and calculations based on the aggregate model may not be valid. (28 refs.)

Double-exposure speckle photography for the measurement of small displacements .... See Entry 64609

Short range structure and some physical properties of the glasses in the system Na_2O-Ga_2O_3-SiO_2 .... See Entry 66871

Thermodeformation properties and structure of polyvinylalcohol films containing boron derivatives .... See Entry 66896

Influence of the structure of a three-dimensional network on the thermal shrinkage of a polymer .... See Entry 66897

Lattice parameters, thermal expansion coefficients and density of vacancies in solid CH_4 .... See Entry 66974

Effect of phosphorus doping on stress in silicon and polycrystalline silicon .... See Entry 67025

Treatment of metals by a beam of electrons for obtaining products with the properties of a bimetal .... See Entry 67048

Thermal expansion coefficient and Young's modulus of hydrogenated FCC Fe-Ni Invar alloys .... See Entry 67087

Thermal expansion and pressure dependence of the critical temperature near the critical solution point of benzonitrile-isooctane .... See Entry 67184

Low temperature structural and magnetic properties of $PrPb_3$ .... See Entry 67189

Theory of order-disorder transitions for inhomogeneous mixed-valence systems .... See Entry 67546

Isomorphic MeX_2O_4 compounds: anisotropic thermal expansion and magnetic order in $MnSb_2O_4$ .... See Entry 67895

Effects of random fields on the phase diagram of $Mn_{0.875}Zn_{0.125}F_2$ .... See Entry 67921

Optical and other physical properties of $Al(PO_3)_3$-containing fluorophosphate glasses .... See Entry 68154

Viscoelastic analysis of glass-to-glass sandwich seals .... See Entry 68579

Low thermal contraction GFRP .... See Entry 68593

65.90 OTHER TOPICS IN THERMAL PROPERTIES OF CONDENSED MATTER

Structural investigation of molten and glassy silicates by means of infrared emission spectrometry .... See Entry 66886

66.00 TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC)

66.10 DIFFUSION AND IONIC CONDUCTION IN LIQUIDS

67249 **Thermogravitational thermal diffusion in binary mixtures of chloroform with acetone, benzene, toluene, and mesitylene.** N.-Y.R.Ma, A.L.Beyerlein (Dept. of Chem. & Geology, Clemson Univ., Clemson, SC, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.245-50 (20 Jan. 1983).
Experimental thermogravitational thermal diffusion studies are reported on chloroform-benzene mixtures at 10, 15, 25, and 35°C and on chloroform-acetone, chloroform-toluene, and chloroform-mesitylene mixtures at 25°C. Thermal diffusion factors (α) are calculated from the data on chloroform-benzene and chloroform-acetone mixtures. For the chloroform-benzene derivative mixtures the products $\alpha\eta D$ (η and D being the viscosity and the diffusion coefficient, respectively) are evaluated. (37 refs.)

67250 **Conductivity of supercooled aqueous potassium chloride solutions to −27°C and 50 MPa.** R.J.Speedy (Chem. Dept., Victoria Univ. of Wellington, Wellington, New Zealand).
J. Phys. Chem. (USA), vol.87, no.2, p.320-4 (20 Jan. 1983).
Specific resistivities of 0.1 and 1.0 M aqueous KCl solutions are reported to −27°C and 50 MPa. The atmospheric pressure results, together with literature values in the concentration range 0-1 M and 0-30°C can be represented to within 1 or 2% by $r=r_2(T/T_8-1)^{-\gamma}$, where r the resistivity, $r_2C_{20}=0.1316(1+0.65\ C_{20}{}^{1/2})\ \Omega$ mol dm^{-2}, $T_8=224.8(1-0.035C_{20}{}^{1/2})$K, and $\gamma=1.45$. C_{20} is the molar concentration of the solutions at 20°C. The results are interpreted as supporting the hypothesis that there is a structuring phenomenon in supercooled water which generates long-range correlations. (27 refs.)

67251 **Effect of ethanol on the conductivity of supercooled aqueous potassium chloride solutions.** R.J.Speedy, J.A.Ballance, B.D.Cornish (Chem. Dept., Victoria Univ. of Wellington, Wellington, New Zealand).
J. Phys. Chem. (USA), vol.87, no.2, p.325-8 (20 Jan. 1983).
Adding ethanol (up to 3 M) to 0.1 M aqueous KCl solutions increased both the resistivity (by up to 300%) and its anomalous temperature coefficient. The effects were more pronounced at lower temperatures. The temperature dependence of the resistivity can be described by $r=r_2(T/T_s-1)^{-\gamma}$, where s the resistivity, r_2 and γ are constants, and T_s is the temperature at which r extrapolates to infinity. The notion that the 'iceberg' structure induced in water by ethanol may be the same as the structure of the low-density species whose cooperative formation is thought to underlie the above temperature dependence of many properties of pure water is discussed. (28 refs.)

67252 **Multiatomic ion models for interdiffusion of liquid silicates.** Y.Oishi, M.Namba (Dept. of Nuclear Engng., Kyushu Univ., Fukuoka, Japan).
J. Phys. Colloq. (France), vol.43, no.C-9, p.391-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Interdiffusion profiles of the system $40CaO.20Al_2O.40SiO_2$ (wt.%) at 1370-1550°C were analysed using multiatomic ion models, in which diffusing species were described with unknown structure parameters and the solution of the diffusion equation for multicomponent ionic systems was derived in terms of self-diffusion coefficients of constituent elements. The compositions of the unknown diffusing species were determined by means of best fitting of the theoretically calculated concentrations to experimentally determined profiles. A similar analysis was conducted also for the system $16Na_2O.12CaO.72SiO_2$ at 1200°C to determine the composition of the unknown silicate ion. (4 refs.)

67253 **Self-diffusion coefficient of nematic liquid crystals from diffusion concentration gradient.** H.Hakemi (Dept. of Chem., Duke Univ., Durham, NC, USA).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.35-7 (11 April 1983).
A dynamic study of the mass transport by optical methods provides a new approach to evaluate the nematic self-diffusion coefficient. This value is obtained by extrapolation to $C=0$ in an empirical relation $D_C=D_0\exp(-\beta C)$, where D_C is the mass-corrected impurity diffusion coefficient and C is the local concentration of the diffusion profile. (12 refs.)

67254 Composition of the highly conducting compound in the RbCl-CuCl system. V.S.Shvetsov, V.F.Vybornov, V.V.Ivanov (Sergo Ordzhonikidze Polytech. Inst., Novocherkassk, USSR).
Sov. Electrochem. (USA), vol.18, no.7, p.878-82 (July 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.7, p.986-90 (July 1982). [received: March 1983]
Electric conductivity in the RbCl-CuCl system has been studied previously. Its maximum value of $2.25.10^{-3}\ \Omega^{-1}.\mathrm{cm}^{-1}$ at 298K corresponds to the composition with 0.75 mole parts of copper chloride. This composition was regarded as compound $RbCu_3Cl_4$ with copper ion conduction. Another value, of $3.0.10^{-3}\ \Omega^{-1}.\mathrm{cm}^{-1}$, was obtained by Takahashi et al. 1979 for the maximum conductivity, and ascribed to a compound $Rb_3Cu_7Cl_{10}$ (0.70 mole parts of copper chloride). It is doubtful that two compounds with similar conductivities will exist at once in this system. The authors performed studies to clarify the composition of the highly conducting compound and determine the conductivity. (5 refs.)

67255 Electrical conductivity of melts in the system $CaO\text{-}MgO\text{-}SiO_2$. T.Licko, V.Danek (Inst. of Inorganic Chem., Centre of Chem. Res., Slovak Acad. of Sci., Bratislava, Czechoslovakia).
Silikaty (Czechoslovakia), vol.27, no.1, p.55-62 (1983). In Czech.
Electrical conductivity of melts in the system $CaO\text{-}MgO\text{-}SiO_2$ was measured within the temperature range of 1670 to 1920K. The temperature dependence of conductivity was described by a second order polynomial. On the assumption that only the Ca^{2+} and Mg^{2+} cations take part in the charge transfer, the dependence of conductivity on composition can be described by an equation related to the limit concentraton of conductive particles at which the melt conductivity approaches zero. The limit concentration c_i° in the systems $CaO\text{-}SiO_2$ and $MgO\text{-}SiO_2$ was found to correspond to the mean concentration value in the immiscibility region. The multiple linear regression function $\chi=f(c_i)$ was used for determining the values of mobility and diffusion coefficients for the Ca^{2+} and Mg^{2+} cations at 1773K and 1873K. It was found that both the mobility and diffusion coefficient of Ca^{2+} are higher than that of Mg^{2+} which may be explained by a higher ionic field strength and thus a stronger Me-O bond in the case of Mg^{2+} cations. (15 refs.)

Temperature dependence of the structure factor of liquid metals .... See Entry 66806

Segregation of In and Te in CdSb .... See Entry 67218

Pre-vitrification viscosity enhancement by longitudinal mode coupling .... See Entry 67259

Computer simulation studies of migration mechanisms in ionic glasses and liquids .... See Entry 67273

Influence of ionic strength on the diffusion of polystyrene latex spheres, bovine serum albumin, and polynucleosomes .... See Entry 68243

66.20 DIFFUSIVE MOMENTUM TRANSPORT

(inc. viscosity of liquids)

67256 Viscosity properties of solutions of polyvinylbutyl ether of atactic and isoatactic structure. L.I.Shakhovskaya, O.G.Kuznetsova.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.2, p.94-5 (1983). In Russian.
A study was made of the influence of the structure (degree of stereoregularity) of solutions of polyvinylbutyl ether in methylethylketone, with atactic and isotactic structures, on the viscosity characteristies of the solutions. It is concluded that existing information does not permit an unambiguous interpretation of the influence of stereoregularity on the viscosity and activation characteristics of solutions and melts of polymers. (8 refs.) *A.J.B.*

67257 Shear viscosities away from the melting line: a comparison of equilibrium and nonequilibrium molecular dynamics. B.L.Holian (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA), D.J.Evans.
J. Chem. Phys. (USA), vol.78, no.8, p.5147-50 (15 April 1983).
Doubts about the validity of the nonequilibrium molecular dynamics (NEMD) methods of computing shear viscosity have persisted, partly because of the apparent disagreement (~25%) between NEMD and equilibrium Green-Kubo (GK) results for the Lennard-Jones system near its triple point. This region of the phase diagram near the melting line is the so-called 'molasses' regime where the tail of the shear-stress autocorrelation function is quite large, deviating from 'exponential' decay at a level of about 10%. In order to see whether the effects of the 'molasses tail' might be obscuring a more profound difference between NEMD and GK results, the authors have carried out independent NEMD and GK calculations for a state in the LJ fluid far away from this troublesome molasses region, namely at a temperature twice critical and a density between the triple and critical points. They find the NEMD and GK results for the linear shear viscosity to be in good agreement. (11 refs.)

67258 Viscous flow and relaxation phenomena in inorganic glass. M.Hara (Asahi Glass Co., Tokyo, Japan).
J. Phys. Colloq. (France), vol.43, no.C-9, p.431-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A model for molecular rearrangement in a continuous viscous medium is proposed and used for analyzing experimental data on stress and structural relaxation of highly quenched glasses below the transformation range. The analysis reveals that the apparent activation energy of viscosity of glass having a constant fictive temperature decreases with falling temperature in contrast to the Arrhenian behavior of viscosity of stabilized glass in a high viscous range. (12 refs.)

67259 Pre-vitrification viscosity enhancement by longitudinal mode coupling. T.Geszti (Res. Inst. for Tech. Phys., Hungarian Acad. of Sci., Budapest, Hungary).
J. Phys. Colloq. (France), vol.43, no.C-9, p.435-7 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A mechanism is described for the viscosity of a simple liquid to grow as $\eta\alpha(T\text{-}T_0)^{-1}$ at some finite T_0. It consists of two main steps: 1) a slowing-down of diffusion-controlled structural relaxation of density fluctuations as $\eta\rightarrow\infty$; 2) an enhancement of viscosity by mode-mode coupling to longitudinal modes which are slowly relaxation in view of 1). (16 refs.)

67260 Viscosity of some glassy minerals. Y.Shiraishi, R.Meister (Vitreous State Lab., Catholic Univ. of America, Washington, DC, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.447-50 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A parallel plate viscometer was constructed by utilizing the combination of a linear variable differential transformer and a microcomputer. The characteristic of this viscometer was determined by the measurement of the viscosity of NBS reference glass 711. The results show that the viscometer was suitable for the measurement of the viscosity range from 10^6 to 10^{10} poise. The dynamic method, which can cover a wide range of viscosity by one measurement run, gives a slightly higher value of viscosity than that of the static method. The viscosity of glassy silicate minerals were measured up to 1100°C by the dynamic method. Some minerals showed clearly the change of viscosity on the viscosity vs. temperature curve which indicates the crystallization of the glass. (3 refs.)

67261 Theory of the effective viscosity of magnetofluids. II. Contribution of anisotropy to the effective viscosity. V.M.Suyazov.
Magnetohydrodynamics (USA), vol.18, no.3, p.211-20 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.3-13 (July-Sept. 1982). [received: April 1983]
For pt.I see Magn. Gidrodin, no.3, p.3-13, 1982. In part I the author formulated a system of equations for a ferrocolloid with allowance for the finite relaxation time of the magnetization and the anisotropic properties of the medium. He determined the anisotropy parameter in the equation of state for the magnetization as a function of the crystalline anisotropy constant of a uniaxial ferromagnet, the particle geometrical anisotropy constant, and the presence of chain aggregates in ferrofluids. He investigates the contribution of anisotropy to the effective viscosity. (no refs.)

The dipole moments of some chloro- and bromopentanes .... See Entry 66155

Effect of shear degradation on the rheological properties of dilute drag-reducing polymer solutions .... See Entry 66543

High viscosity (10^4-10^{11} Pa.s) measurements by the penetrometer method at low temperature (77-300K) .... See Entry 66656

Anisotropic solutions of methylol cellulose .... See Entry 66804

Temperature dependence of the structure factor of liquid metals .... See Entry 66806

Physicochemical properties, critical temperatures, and evaporation enthalpies of alkylalkoxysilanes and arylalkoxysilanes .... See Entry 67174

Nucleate boiling in drag-reducing polymer solutions .... See Entry 67180

Glass transition as a function of cooling rate .... See Entry 67207

Thermogravitational thermal diffusion in binary mixtures of chloroform with acetone, benzene, toluene, and mesitylene .... See Entry 67249

Transport processes in glass .... See Entry 67272

Computer simulation studies of migration mechanisms in ionic glasses and liquids .... See Entry 67273

Dielectric relaxation of some associated liquids in highly viscous media .... See Entry 68119

Viscous failure of glass at high shear rates .... See Entry 68631

66.30 DIFFUSION IN SOLIDS

Comparison between natural and synthetic grain boundaries by means of discontinuous precipitation .... See Entry 67011

66.30D Theory of diffusion and ionic conduction in solids

67262 Quantum diffusion at intermediate temperatures. M.Lagos (Facultad de Fisica, Univ. Catolica de Chile, Santiago, Chile).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.47-51 (11 April 1983).
A new closed-form expression for the diffusion coefficient, valid in a wide range of temperatures (including the intermediate ones), is obtained in the framework of the theory of quantum diffusion. The new formula fits well the available experimental data on μ^+ diffusion in Cu in the whole temperature range. The origin of the discrepancies of previous theoretical expressions with high temperature measurements are explained in detail. (6 refs.)

67263 Variants of the same model for solute diffusion by the interstitial dumb-bell in the FCC lattice. J.L.Bocquet (Section de Recherches de Metall. Phys., CENS, Gif-sur-Yvette, France).
Philos. Mag. A (GB), vol.47, no.4, p.547-77 (April 1983). In French.
Two variants of the same basic model for solute diffusion by the interstitial dumb-bell mechanism are presented. The pure and mixed dumb-bells are allowed to jump to a nearest-neighbour position by the usual mechanism (combining a translation and a rotation) and to rotate about their own sites. The return probabilities of the pure dumb-bell on the tracer atom are calculated via a double Fourier and Laplace transformation of the transport equations. The mean-square displacement of the tracer atom, which is due to a single defect, is analysed in terms of macrojumps; a macrojump is defined as the whole sequence of elementary jumps which results in the net transport of the tracer atom from one substitutional site to another substitutional site of the f.c.c. lattice; its length depends on the various jump frequencies which are available for the tracer atom when the latter resides on an interstitial location. (11 refs.)

67264 Two-frequency model of self-diffusion in crystals. V.A.Panteleev, V.M.Vorob'ev, V.A.Murav'ev (Physicotech. Res. Inst., N.I. Lobachevski State Univ., Gorki, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1581-3 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2794-8 (Sept. 1982). [received: April 1983]
A new model is put forward for self-diffusion in crystalline solids. It is based on the hypothesis that vacancy jumps to the second coordination sphere are possible. Experiments are derived for the self-diffusion coefficient of the diamond, BCC, and FCC structures. The results are used to account for observed deviations from the Arrhenius law in silicon and normal BCC and FCC metals. Quantitative estimates of the energy barrier for vacancy hops of the new type are given. The results are in good agreement with experiment. (24 refs.)

Kinetics of a unidirectionally inhomogeneous Ising alloy .... See Entry 67160

Quantum diffusion and recombination of atoms in a crystal at low temperatures .... See Entry 67307

66.30F Self-diffusion in metals, semimetals, and alloys

67265 Vanadium self-diffusion in pure vanadium and in dilute vanadium-iron and vanadium-tantalum alloys. D.Ablitzer, J.P.Haeussler, K.V.Sathyaraj (Ecole Nat. Superieure de la Metall. et de l'Industrie des Mines, Nancy, France).
Philos. Mag. A (GB), vol.47, no.4, p.515-28 (April 1983).
Measurements of vanadium self-diffusion have been made over the temperature range 1050-1874°C. The solute enhancement factor b for vanadium self-diffusion has also been measured in dilute vanadium-iron and vanadium-tantalum alloys. These results, together with the authors' previously published

results on iron impurity diffusion in vanadium, are analysed using the vacancy models of Le Claire (1970) and Jones and Le Claire (1972) to calculate the isotope effect parameters f_i, which are then compared with the measured values of $f_i\Delta K$ of Coleman, Wert and Peart (1968). The authors results confirm the existence of three regimes: (1) free single vacancy migration between 1200 and 1550°C, (2) divacancy contribution at higher temperatures and (3) acceleration of diffusion due to other defects such as dislocations, subgrain boundaries and/or vacancy-interstitial impurity pairs at low temperatures. (14 refs.)

67266 Properties of metal hydrides. II. Y.Fukai.
Solid State Phys. (Japan), vol.17, no.12, p.701-16 (Dec. 1982). In Japanese. [received: April 1983]
For pt.I see ibid., vol.16, p.253 (1981). Experimental results on diffusion processes of hydrogen in metals have been reviewed, and a possibility for their consistent explanation in terms of a quantum-mechanical approach has been proposed. (50 refs.)

Two-frequency model of self-diffusion in crystals ....See Entry 67264

A ^{1}H NMR study of the effects of Ni additions on the behavior of hydrogen in β-vanadium hydride ....See Entry 68062

The effect of molybdenum in Type 316 stainless steel on grain boundary self-diffusion and creep rate at low stresses ....See Entry 68592

66.30H Self-diffusion and ionic conduction in nonmetals

67267 Autodiffusion of ^{45}Ca in calcium vanadates. T.I.Krasnenko, A.S.Zhukovskaya, B.V.Slobodin, A.A.Fotnev (Inst. of Chem., Ural Sci. Centre, Acad. of Sci., Sverdlovsk, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.845-7 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1005-7 (June 1982). [received: Feb. 1983]
The autodiffusion of ^{45}Ca was studied in polycrystals of $Ca(VO_3)_2$, $Ca_2V_2O_7$ and $Ca_3(VO_4)_2$ at 820-1170K. The concentration dependences of the distribution of ^{45}Ca in all the samples studied are characterised by the presence of two portions where the diffusion coefficients differ by an order of magnitude. The following relationship of the autodiffusion coefficients at temperatures above 920K was established: $D[Ca(VO_3)_2] > D[Ca_2V_2O_7] > D[Ca_3(VO_4)_2]$.

67268 Electrical conductivity and nature of the charge carriers in single crystals of compounds Cs_2HgX_4 (X=Cl, Br, I). V.V.Danilov, V.S.Vorob'ev, A.V.Bogdanova, Z.U.Borisova (A.A. Zhdnov Leningrad State Univ., Leningrad, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.863-5 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1025-7 (June 1982). [received: Feb. 1983]
With respect to their parameters of electrical conductivity, the ternary compounds Cs_2HgCl_4 and Cs_2HgBr_4 can be considered as wide-band semiconductors. The contribution of the H^+ and OH^--ion components of conductivity increases in the order $Cs_2HgCl_4 \rightarrow Cs_2HgBr_4 \rightarrow Cs_2HgI_4$. (4 refs.)

67269 Ion clustering and proton transport in Nafion membranes and its applications as solid polymer electrolyte. R.S.Yeo (Pinnacle Res. Inst., Cupertino, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.533-8 (March 1983).
The concentrations of fixed ion in Nafion membranes have been calculated based on both the homogeneous model and the ion cluster model while the concentrations of co-ion were calculated from the Donnan expression. The experimental results on the concentrations of co-ion reveal that the ions in this material do form clusters and the membrane also exhibits a strong Donnan exclusion effect. The ionic mobilities obtained from the conductivity and diffusivity studies are in fairly good agreement. Strong acidity coupled with high proton mobility in this membrane provide an important solid polymer electrolyte for a variety of electrochemical applications. The impact of polymer morphology on cell performance is also discussed. (61 refs.)

67270 The AC conductivity of polycrystalline LISICON, $Li_{2+2x}Zn_{1-x}GeO_4$, and a model for intergranular constriction resistances. P.G.Bruce, A.R.West (Dept. of Chem., Univ. of Aberdeen, Aberdeen, Scotland).
J. Electrochem. Soc. (USA), vol.130, no.3, p.662-9 (March 1983).
The AC conductivity of a polycrystalline, Li^+ ion conducting solid electrolyte, LISICON, $Li_{2+2x}Zn_{1-x}GeO_4$, has been measured over the frequency range 10^{-3}-10^7 Hz and attention focused on the methods of data analysis. The data show intragranular (bulk) and grain boundary effects in which, for a given sample, both effects are characterized by a similar activation energy; a constriction resistance model for the latter is proposed based on air gaps existing in polycrystalline sinters of less than theoretical density. The data only crudely fit a Debye-like equivalent circuit, composed of frequency independent resistors and capacitors, but fit well an equivalent circuit that contains Jonscher elements, i.e. frequency dependence admittances, in addition to normal *R* and *C* elements. Two such Jonscher elements are needed, one for the grain boundary and one for the intragranular contribution. With this circuit, departures from ideality in, for example, the complex impedance, admittance, and electric modulus planes are accounted for. (26 refs.)

67271 The electrical and optical properties of sodium germanate glasses. M.N.Khan, E.E.Khawaja (Dept. of Phys., Univ. of Petroleum & Minerals, Dhahran, Saudi Arabia).
J. Phys. Colloq. (France), vol.43, no.C-9, p.319-22 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The electrical conductivities of a series of specimens in the system Na_2O-GeO_2 were measured at temperatures ranging from room temperature to 350°C. These results are interpreted in terms of electrical gaps, which decrease linearly with the Na_2O content of the glasses. Their absorption edges are measured and analysed in terms of forbidden non-direct transitions across an optical energy gap which is also found to increase linearly with the Na_2O content of the glasses. However, the optical gap was found roughly to be twice the corresponding electrical gap. (6 refs.)

67272 Transport processes in glass. A.R.Cooper,Jr. (Dept. of Metall. & Materials Sci., Case Western Reserve Univ., Cleveland, OH, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.369-80 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The rate of glass melting depends on the combined influence of the transport of several quantities: heat, momentum, species, and electric charge. The phenomenology of each of these processes obey a similar set of laws and there are a variety of carriers and several modes of transport for each. The transport efficients are likewise related and depend on the self-diffusion coefficients of species, phonons and photons. Thermal conductivity and viscosity of glass forming liquids are discussed from this point of view. (41 refs.)

67273 Computer simulation studies of migration mechanisms in ionic glasses and liquids. C.A.Angell, P.A.Chesseman, S.Tamaddon (Dept. of Chem., Purdue Univ., West Lafayette, IN, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.381-5 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Ion dynamics computer simulations of the migration of cation and anions in 'computer glasses' and liquids of silicate and fluoride types are reported, and examples of diagnostic power of the simulation method are given. The existence of high pressure minima in the viscosity of molten aluminosilicates in indicated. (6 refs.)

67274 Simple models for the ionic conduction mechanism in glasses. J.O.Isard, M.Jagla, K.Mallick (Dept. of Ceramics, Glasses & Polymers, Univ. of Sheffield, Sheffield, England).
J. Phys. Colloq. (France), vol.43, no.C-9, p.387-90 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Many glasses show relatively high lithium ion conductivities which result from low activation energies. The activation energy is attributed to (i) the elastic distortion of 'doorway' and (ii) the separation of cationic from anionic charges. Simple calculations for a rigid network show that the contribution of (i) to the activation energy is least for Li^+ compared with the other alkali metal ions, while the contribution of (ii) is the greatest for this ion. The calculated value for Li^+ is larger than the observed activation energy. It is suggested that the Li-conducting glasses are ionic with anionic groups having freedom to rotate and 'hand-on' Li^+ ions from one group to another, and the Li^+ ions can 'roll around' the anions. The effect of dielectric relaxation may also lower the activation energy. (15 refs.)

67275 Pre-exponential term in the Arrhenius equations for electric conductivity of glass. C.T.Moynihan, D.L.Gavin, R.Syed (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.395-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Very precise electrical conductivity data on a series of six glasses of molar composition $25(xNa_2O.(1-x)K_2O)$-$5Al_2O_3$-$70SiO_2$ with $0.95 \leq x \leq 1$ have been obtained over a large temperature range (~310°C). Analysis of this data suggests that the pre-exponential term in the Arrhenius conductivity equation is temperature independent. (14 refs.)

67276 Electrical impedence and concentration fluctuations in silica-based glasses. D.Ravaine (Lab. d'Energetique Electrochimique, ENSEEG, Saint-Martin d'Heres, France), A.F.Wright.
J. Phys. Colloq. (France), vol.43, no.C-9, p.399-402 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A model is proposed for the interpretation of the circular arcs observed for the electrical impedances of ion-conducting glasses when plotted in the complex plane. By fitting with experimental results, this model leads to the determination of concentration fluctuations in glasses and finds good support from comparison with SANS data and thermodynamic calculations. The extension of crystalline ionic conductors is suggested. (11 refs.)

67277 Ionic conducting glasses of the Li_2S-GeS_2-LiI system. Their use in 'all-solid' generators with lithium anodes. M.Ribes, B.Carette, M.Maurin (Lab. de Chimie Minerale, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.403-6 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
In the Li_2S-GeS_2-LiI system, glasses have been synthesized with an electrical conductivity higher than $10^{-4}\Omega^{-1}$ cm^{-1} (at 25°C), a transference number ti=1, a stability redox range higher than 3 volts and stable against lithium metal (at least at room temperature). These characteristics have made it possible to use them as electrolytes in all-solid button cells of lithium anode/glass/composite cathode, the first results of which (polarization, discharge curves...) are presented. (14 refs.)

67278 Alkali fluoride containing ZrF_4-based glasses: electrical properties and NMR investigation. D.Ravaine, W.G.Perera, M.Minier (Lab. d'Energetique Electrochimique, ENSEEG, Saint Martin d'Heres, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.407-10 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
New results obtained on alkali fluoride containing ZrF_4-based glasses from electrical and NMR measurements are used for the interpretation of the anionic conduction mechanism in fluoride glasses. Local F^- motions arise in the vicinity of modifier cations while long range displacements are related to the network former polyhedron arrangement. (9 refs.)

67279 Electrical properties of rapidly quenched lithium-silicate glasses. M.Yoshiyagawa, M.Tomozawa (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.411-14 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Li_2O-SiO_2 glasses with high Li_2O content (33-62 mole% Li_2O) were presented by a twin roller quench apparatus, and their electrical characteristics were measured as function of temperature. Glass specimens with conductivity as high as $10^{-5}\Omega^{-1}cm^{-1}$ at room temperature were obtained. As far as DC conductivity was concerned, rapid quenching was equivalent to increasing the alkali content. On the other hand, the quenching rate had little influence on high frequency (or low temperature) electrical characteristics. This suggests that the quenching rate affects mainly the long range motion of alkali ions. (10 refs.)

67280 Ionic conductivity of Li_2O-$(LiCl)_2$-B_2O_3-Al_2O_3 glasses. Huang Xihuai, Huang Pengnian (Shanghai Inst. of Ceramics, Chinese Acad. of Sci., Shanghai, China).
J. Phys. Colloq. (France), vol.43, no.C-9, p.415-18 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The ionic conductivity, dynamical compressibility, IR and Raman spectra, as well as Li^+-H^+ ion exchange properties were investigated for Li_2O-$(LiCl)_2$-B_2O_3-Al_2O_3 glasses. The electrical properties were interpreted from the point of view of the glass structure. (6 refs.)

67281 Dynamics of ions of the two-dimensional superionic conductor $AgCrS_2$. P.Bruesch, T.Hibma (Brown-Boveri Res. Center, Baden, Switzerland), W.Buhrer.
Phys. Rev. B (USA), vol.27, no.8, p.5052-61 (15 April 1983).
$AgCrS_2$ is a quasi-two-dimensional superionic conductor for silver ions which shows a second-order phase transition at T_c=673K. Well below T_c, $AgCrS_2$ is ordered and pyroelectric; above T_c the silver ions are disordered and the

phase is nonpyroelectric. The ion dynamics below T_c has been studied by means of far-infrared and inelastic neutron scattering experiments. The most interesting feature of the phonon structure is the existence of very-low-frequency acoustic and flat optic modes. The low-frequency TO mode at $q=0$ shows a strong and anomalous temperature dependence down to 10K. The authors show that this temperature dependence can be explained by a highly anharmonic motion of a particle in an effective potential. The patterns of ionic displacements of the low-frequency modes have been obtained from a calculation based on a rigid-ion model. This calculation shows that in the low-frequency modes the silver ions are strongly involved and vibrate parallel to the layers. These modes therefore contributed strongly to the mean-square displacements of the silver ions and to the reaction coordinates for ionic jumps. The jumps of silver ions reduce the spontaneous polarization of the pyroelectric phase and finally lead to the order-disorder pyroelectric phase transition at T_c. (19 refs.)

67282 Behavior of the activation energy for ionic conduction in $RbAg_4I_5$ near 209K. R.A.Vargas, A.T.Bravo (Dept. de Fisica, Univ. del Valle, Cali, Colombia).
Rev. Mex. Fis. (Mexico), vol.29, no.2, p.197-201 (Feb. 1983).
The authors have examined the 209K phase transition of $RbAg_4I_5$ by measuring the differentials of the sample resistance as a function of temperature on single crystals. Their results reveal a continuous variation of the activation energy with temperature through the transition which is attributed to the dominant effect of short range order on the ionic conductivity. (11 refs.)

67283 Rapid anion transfer in Bi_2WO_6 crystals. V.K.Yanovskii, V.I.Voronkova, Yu.E.Roginskaya, Yu.N.Venevtsev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1603-4 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2829-31 (Sept. 1982). [received: April 1983]
The authors show that the ionic conductivity in Bi_2WO_6 single crystals is anomalously high, and a possible correlation between the rapid transfer of oxygen anions and the polar nature of the crystals is discussed. Measurements of electrical conductivity in the range 20-1000°C were carried out in air according to the two-electrode method with alternating current. The authors also investigated the dependence of conductivity on frequency in the range 10^2-2.5×10^8 Hz. (7 refs.)

67284 Conductivity of the Li_4GeO_4-Li_3PO_4 solid-phase binary system. V.A.Bakaev, L.S.Leonova (Inst. of New Chem. Problems, Acad. of Sci., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.6, p.659-62 (June 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.6, p.743-6 (June 1982). [received: Feb. 1983]
The conductivity of the Li_4GeO_4-Li_3PO_4 solid binary system in the range of compositions from 10 to 50 mole% phosphate has been measured. The maximum conductivity is achieved when the Li_3PO_4 content is 20 mole%. The addition of $LiTaO_3$ and Li_2O improves the sintering quality and increases the conductivity of the solid solutions. From a comparison of the current-voltage characteristics with reversible and blocked electrodes it follows that the conductivity of the system studied has a predominantly ionic character. (5 refs.)

Investigation of the photoelastic effect in titanium-diffused optical waveguides in lithium niobate .... See Entry 66384

Effect of water content on properties of Na_2O3SiO_2 glasses ... See Entry 66889

Protonic solid electrolytes: a single-crystal neutron diffraction study of ammonium-hydronium β''-alumina .... See Entry 66949

Neutron scattering study on distribution of cations in α-AgI-type superionic conductors .... See Entry 66956

Pure diffusional creep of NiO polycrystals .... See Entry 67101

Cooperative phenomena: a simple model for phase transitions in solid electrolytes .... See Entry 67162

Stability behaviour of mixed conducting solids after applying electrical potential differences—measurements with point electrodes on Ag_2S and Cu_2S .... See Entry 67211

Two-frequency model of self-diffusion in crystals .... See Entry 67264

Electric field enhanced diffusion in trans-(CH) .... See Entry 67295

Thermo-EMF of cells with a $ZrO_2+Y_2O_3$ electrolyte in atmospheres of different compositions .... See Entry 67667

66.30J Diffusion, migration, and displacement of impurities

67285 Verification of the model for phosphorus diffusion from oxide sources into silicon. A.Checielewska (Inst. of Electron Technol., Sci. & Production Centre of Semiconductors, Warszawa, Poland).
Electron Technol. (Poland), vol.13, no.1-2, p.3-17 (1980).
The model of dopant diffusion from oxide sources into silicon has been confirmed by experiments using phosphorus diffusion at 1050°C as an example. In the range of concentration in silicon 10^{18}-2×10^{20} cm^{-3} the computed phosphorus profiles are in good agreement with the measured concentration distributions. Also, the basic relations between parameters of a diffusion process are described in detail by the model. The segregation constant and concentration dependences of diffusion coefficients in silicon and oxide, taken into consideration in the model, have been determined from experiments. (39 refs.)

67286 As migration during PtSi formation. A.H.Hamdi, F.D.McDaniel (Dept. of Phys., North Texas State Univ., Denton, TX, USA), S.R.Wilson.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1738-40 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The migration of implanted As during PtSi formation on (100) Si wafers has been studied by Rutherford backscattering techniques. Two thicknesses of PtSi layer (50 and 200 nm) have been chosen for this study. The PtSi formation temperatures were either 525°C or 625°C. The data show that the number of the migrating As atoms is independent of the PtSi thickness or formation temperatures used in this investigation. (19 refs.)

67287 Boron diffusion during electron pulse annealing of silicon. J.M.Dilhac, C.Ganibal, G.Vialaret, A.Martinez (Lab. d'Automatique et d'Analyse des Systemes, CNRS, Toulouse, France).
J. Appl. Phys. (USA), vol.54, no.4, p.2111-13 (April 1983).
Results concerning boron diffusion during electron pulsed annealing of silicon are presented. The initial boron profile is realized by successive implantations at 50, 80, and 190 keV. Dopants diffusion is explained theoretically in terms of liquid phase diffusion. Electrical acitivity is about 100%. (12 refs.)

67288 Alkali migration in glasses on electron, proton and heavier ion irradiation. G.Battaglin, G.Della Mea, G.de Marchi, P.Mazzoldi (Istituto di Fisica, Univ. di Padova, Padova, Italy), A.Miotello, M.Guglielmi.
J. Phys. Colloq. (France), vol.43, no.C-9, p.645-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The authors present a systematic study of the Na profile modifications in soda-lime silica glasses after electron, proton and heavier ion irradiations. The results are discussed in terms of field assisted diffusion and Na preferential sputtering. (14 refs.)

67289 Photostimulated diffusion of light substitutional impurities in semiconductors and insulators. V.N.Pavlovich (Inst. for Nuclear Res., Acad. of Sci., Kiev, Ukrainian SSR).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K9-14 (1 March 1983).
The influence of resonant infrared light on the diffusion of light substitutional impurities in semiconductors and insulators is discussed. The influence of the redistribution of impurity atoms on the diffusion coefficient of the substitutional impurities depends on the mechanism of diffusion of the given impurity. When the vacancy mechanism of diffusion takes place the impurity hopping rate into nearest vacant site is increased. When the dissociative mechanism is realized the dissociation constant, i.e. the possibility of an impurity transition from a site to an interstice is increased. (10 refs.)

67290 Mechanism of impurity diffusion in a-Si:H and diffusion blocking by fluorine inclusion. H.Matsumura, K.Sakai, M.Maeda, S.Furukawa (Dept. of Appl. Electronics, Tokyo Inst. of Technol., Yokohama, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.938-40 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Diffusion of impurities such as boron or antimony in both the glow-discharged a-Si:H and a-Si:F, H is studied by the nuclear reaction technique and the Rutherford backscattering technique. The diffusion constant and its activation energy are evaluated and are compared with those of hydrogen in a-Si:H. The diffusion constant of the impurity in a-Si:H depends only weakly on the impurity itself but is equal to the diffusion constant of hydrogen. That is, impurity diffusion is controlled by the movement of hydrogen. Impurity diffusion is apparently blocked in the film containing fluorine, a-Si:F, H. (10 refs.)

67291 Simple estimation of impurity diffusion coefficients in pure metals. D.L.Beke, F.J.Kedves (Inst. for Appl. Phys., L. Kossuth Univ., Debrecen, Hungary).
Z. Metallkd. (Germany), vol.74, no.4, p.238-40 (April 1983).
On the basis of the law of corresponding states for metals the simple and useful relation ln $D_i/D=A_1(T_R).\alpha/T_m$ was derived, where D_i and D are the impurity and self-diffusion coefficients, T_m is the melting point of the pure matrix metal, α is the initial slope of the median line of the solidus and liquidus, and $A_1(T_R)$ is common function of the reduced temperature, in which $T_R=T/T_m$ for metals having identical structures. The relation is valid whether the diffusion coefficients measured satisfy an Arrhenius-type relation or not. As an example, this relation was examined for impurity diffusion in Nb, Ta, Mo, W and in Cu, Ag, Ni and Al, and it was concluded that it described the experimental data well. (28 refs.)

Kinetics of hydrogen-monovacancy interactions in metals .... See Entry 67033

Trapping of impurity atoms by defects and the distribution of clusters during ion bombardment of growing films .... See Entry 67065

Copper precipitation in long-time diffused silicon .... See Entry 67212

Segregation, diffusion, and solubility of Sn in CdSb .... See Entry 67215

Solubility of In in CdSb .... See Entry 67217

Diffusion of arsenic and phosphorus in laser-processed-polycrystalline-silicon-thin-films .... See Entry 67413

Formation of high asymmetric oxide tunnelling barriers on niobium and tantalum .... See Entry 67805

Growth of $Cd_{1-x}M_xCr_2Se_4$ single crystals (M=In, Al, Ag, Cu) by chemical transport reaction method .... See Entry 68432

On the existence of hydrostatic stress fields for mode II hydrogen embrittlement .... See Entry 68650

66.30L Diffusion, migration, and displacement of other defects

67292 Diffusion induced grain boundary migration and recrystallization in the Cu-Ni system. F.J.A.den Broeder (Philips Res. Labs., Eindhoven, Netherlands), S.Nakahara.
Scr. Metall. (USA), vol.17, no.3, p.399-404 (March 1983).
Presents the most important conclusions of a diffusion induced grain boundary migration (DIGM) study in the Cu-Ni system, which enable the authors to settle the controversy between the kinetic and thermodynamic treatments, and to reformulate the driving force for DIGM. They also report a new important phenomenon related to GB diffusion, which is called diffusion induced recrystallization (DIR). It is argued that DIR, like DIGM, is basically caused by the unequal GB diffusion flows of the two species. The Cu-Ni system was chosen because it is well established that Cu is the faster volume-diffusing species at all compositions, a situation which probably also holds for GB diffusion. It is therefore interesting to study DIGM both for the diffusion of Ni into Cu GBs and vice versa, as a function of temperature. (18 refs.)

Influence of the orientation of anisotropic impurity-vacancy complexes upon dislocation charging in NaCl crystals .... See Entry 67031

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep .... See Entry 67100

Drift of excitons in nonuniformly illuminated crystals .... See Entry 67477

66.30N Chemical interdiffusion

67293 Physical properties of Ni contacts to CdTe. A.M.Mancini (Istituto do Fisica, Univ. e Sezione INFN, Bari, Italy), E.Perillo, A.Quirini, E.Rosato, G.Spadaccini, L.Vasanelli.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1741-2 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The processes occurring during the heat treatment of Ni coated CdTe crystals have been investigated by means of Rutherford Backscattering Spectroscopy, X-ray diffraction measurements and Auger Electron Spectroscopy. The heat treatment, at temperatures higher than 350°C, gives rise mainly to a solid-solid reaction between Ni and Te to form a mixture of NiTe and $NiTe_2$.

Small quantities of Ni tellurates have been also detected on the sample surfaces. (8 refs.)

67294 Lateral growth of titanium silicide over a silicon dioxide layer. P.Revesz, J.Gyimesi, L.Pogany, G.Peto (Central Res. Inst. for Phys., Budapest, Hungary).
J. Appl. Phys. (USA), vol.54, no.4, p.2114-15 (April 1983).
If a silicon dioxide step on a single crystal of silicon covered with titanium is annealed, then, following vertical growth on the silicon part, lateral growth of titanium silicide takes place over the oxide layer. In the temperature range 750-950°C this lateral growth of Ti-silicide was found to be a linear function of the square root of the annealing time. The activation energy of the lateral growth was found to be 1.89 eV. During lateral growth the Ti-silicide forms a deep spike in the silicon crystal at the SiO_2 step. (5 refs.)

Ion-induced amorphous and crystalline phase formation in Al/Ni, Al/Pd, and Al/Pt thin films .... See Entry 67054

Formation of $MoSi_2$ by pulsed electron beam irradiation onto a vapor deposited molybdenum/silicon structure .... See Entry 67375

Microstructural features of Zircaloy-2 and stainless steel AISI-304 L electron beam joint .... See Entry 67376

Si-metal interface reaction and bulk electronic structure of silicides .... See Entry 67783

Photoemission studies of reactive diffusion and localized doping at II-VI compound semiconductor-metal interfaces .... See Entry 68404

66.30Q Electromigration

67295 Electric field enhanced diffusion in trans-(CH). J.H.Kaufman, E.J.Mele, A.J.Heeger, R.Kaner, A.G.MacDiarmid (Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.571-4 (March 1983).
A theory is developed which shows how high power and high current densities can be generated by a $(CH)_x$ battery cell despite the slow diffusion and low conductivity characteristic of ionic motion in polyacetylene. The presence of a small driving potential (or a load) causes current to flow and generates a large electric field within the fibrils. This field dramatically increases the ion transport rate when the electronic screening length is comparable to or greater than the radius of a fibril. (17 refs.)

66.70 NONELECTRONIC THERMAL CONDUCTION AND HEAT-PULSE PROPAGATION IN NONMETALLIC SOLIDS

(for thermal conduction in solid metals, see 72.15C and 72.15E; for statistical mechanics of lattice vibrations, see 63.70)

67296 Lattice thermal resistivity of III-V compound alloys. S.Adachi (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
J. Appl. Phys. (USA), vol.54, no.4, p.1844-8 (April 1983).
Lattice thermal resistivities of III-V compound alloys have been analyzed with a theoretical prediction based on a simplified model of the alloy-disorder scattering. The theoretical prediction shows a quite good agreement with the experimental data on various III-V ternary compounds. This model has also been applied to obtain the thermal resistivity of $In_{1-x}Ga_xAs_yP_{1-y}$ lattice matched to InP for the composition of $0 \leq y \leq 1.0$. The result indicates that the thermal resistivity increases markedly with alloying and exhibits a maximum value of about 24 W^{-1} deg cm at an alloying composition of $y \approx 0.75$. (13 refs.)

67297 On the use of penetration depth in thermal transient finite element analysis. G.Szabolcs (Inst. for Electrical Power Res., (VEIKI),,Hungary). Budapest.
Nucl. Eng. & Des. (Netherlands), vol.74, no.1, p.139-40 (Jan. 1983).
The author estimates the element sizes in heat conduction analysis using finite elements. The author considers the problem of one-dimensional heat conduction in a semi-infinite solid. The surface was subjected to convective boundary condition. (3 refs.)

Effect of composition of glass ceramics of the system K_2O-SrO-BaO-Al_2O_3-SiO_2 on their structure and heat resistance .... See Entry 66852

X-ray investigation of electron-irradiated quartz .... See Entry 66965

Glass transition and thermal stability of blends composed of polycarbonate and poly(ethylene terephthalate) .... See Entry 67210

Transport processes in glass .... See Entry 67272

Two thermomagnetic effects and the electronic thermal conductivity in *p*-GaSb .... See Entry 67662

The preparation of fine grained thermoelectric alloys by vacuum hot pressing .... See Entry 67668

Evidence for scattering of phonons from magnetic excitations in amorphous spin glasses .... See Entry 67936

67.00 QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM

(see also 05.30 Quantum statistical mechanics)

67.20 QUANTUM EFFECTS ON THE STRUCTURE AND DYNAMICS OF NONDEGENERATE FLUIDS

67298 Unsteady He^4 convection and related quantum constraints. T.H.K.Frederking (Walther-Meissner Inst., Garching, Germany).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.711-19 (1982).
In the course of transient stability studies of He II-cooled NbTi/Cu localized Benard convection may be observed in a He I layer above the lambda temperature. In this context quantization conditions are studied for the Newtonian fluid He I involving Onsager-Feynman vortices with quantized circulation. Stability data obtained support evolution of He I layer convection from cellular order toward turbulent disorder ('catastrophe'). Onset data support a vortex number of unity per cell consistent with minimum expenditure rates. (13 refs.)

67.40 BOSON DEGENERACY AND SUPERFLUIDITY OF HELIUM-4

Unsteady He^4 convection and related quantum constraints .... See Entry 67298

Direct and thermal desorption of ^{4}He films .... See Entry 67305

On the disappearance of superfluidity in helium films .... See Entry 67306

67.50 FERMI FLUIDS; LIQUID HELIUM-3

67299 Rotating nulear demagnetization refrigerator for experiments on superfluid He^3. P.J.Hakonen, O.T.Ikkala, S.T.Islander, T.K.Markkula, P.M.Roubeau, K.M.Saloheimo (Low Temperature Lab., Helsinki Univ., Helsinki, Finland), D.I.Garibashvili, J.S.Tsakadze.
Cryogenics (GB), vol.23, no.5, p.243-50 (May 1983).
A nuclear demagnetization cryostat, capable of producing submillikelvin temperatures during rotational motion, was constructed. The apparatus has been used for NMR experiments on superfluid He^3 at angular velocities up to 1.5 rad s^{-1}. The essential technical details and the operation of the cryostat are described. (38 refs.)

67300 Microscopic determination of the self energy of ^{3}He. E.Krotscheck (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), R.A.Smith.
Phys. Rev. B (USA), vol.27, no.7, p.4222-35 (1 April 1983).
From Planck's constant, the mass of a ^{3}He atom, and the 'Hartree-Fock dispersion 2' potential (which describes ^{4}He quite well) the authors calculate the ground-state energy and the complex self-energy of liquid ^{3}He. The calculations are performed within the framework of correlated-basis-function theory. The starting point in this method is an optimised Fermi hypernetted-chain calculation. Improvements on the wave function are incorporated through nonorthogonal perturbation theory. For the energy, they include corrections of second and third order in the effective two-body interaction as well as second-order terms in the effective three-body interaction. Second- and third-order perturbative corrections to the self-energy of a ^{3}He atom reveal a rapid variation with both energy and momentum in the vicinity of the Fermi surface. This effect is shown to be due to the attractiveness of the effective interaction in the spin channel. The results are in quantitative agreement with phenomenological determinations of the self-energy based on the experimental specific heat. (25 refs.)

67301 Nonanalytic supercurrents in ^{3}He-*A*. P.Muzikar (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA), D.Rainer.
Phys. Rev. B (USA), vol.27, no.7, p.4243-50 (1 April 1983).
The energy gap of the *A* phase of superfluid ^{3}He has two singular points on the Fermi surface. These singular points lead to various theoretical puzzles, including one recently discovered by Volovik and Mineev (1981). These authors, using a generalised—gauge-transformation approximation, find a term in the $T=0$ supercurrent which is nonanalytic in gradients of the order parameter. The present authors use the quasiclassical equations invented by Eilenberger (1968) to check the validity of their approximation; They find that the generalised—gauge-transformation approximation fails, in that terms it leaves out make important (in fact, divergent) contributions to the nonanalytic supercurrent. They then formulate a new way to calculate the leading nonanalytic terms in the supercurrent. (10 refs.)

67302 Pulsed nuclear magnetic resonance and soliton lattice in ^{3}He-*A*. M.Nakahara, K.Maki (Dept. of Phys., Univ. of Southern California, Los Angeles, CA, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4456-8 (1 April 1983).
When the magnetisation of ^{3}He-*A* is tipped by a finite angle, the magnetisation precesses with definite angular velocity reflecting the underlying texture. The authors analyse theoretically the precession frequency in the presence of composite solitons in ^{3}He-*A* and compare the results with recent experiments of Giannetta et al (1981) and of Gould et al (1980). (9 refs.)

Singlet superfluidity in ^{3}He film on ^{4}He film .... See Entry 67304

Field dependences of magnetisation and specific heat coefficient in a nearly magnetic system: Liquid ^{3}He and strong Pauli paramagnets .... See Entry 67879

Ginzburg-Landau expansion for copper pairs with nonzero angular momentum and analogy between spin glasses and Cooper pair system ...... See Entry 67929

67.60 MIXED SYSTEMS; LIQUID HELIUM 3-4 MIXTURES

67303 Sound absorption in weak He^3-He^4 solutions at high densities and low temperatures. V.N.Grigoriev, N.E.Dyumin, L.S.Dikina, S.V.Svatko.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.341-9 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The coefficient of the first sound absorption is measured in He^3-He^4 solutions of molar concentrations 0.5 and 0.05% He^3 at constant densities 0.153, 0.159, 0.165 0.170 *g/cm3*. The measurements were made at temperatures below 0.9K and at frequency 29.8 *MHz*. The analysis of experimental results shows that at all the densities investigated the sound absorption in the solution containing 0.5% He^3 is determined by the He^3 viscosity and the scattering by thermal phonons, whose mean free path is limited by He^3 impurities. The sound absorption in the 0.05% He^3 solution is qualitatively the same as in pure He^4 which means that at moderately high densities, the initial part of the phonon spectrum with low He^3 fractions still reveals decay. The time of transverse phonon relaxation in He^4 at 1.1 *atm* is found along with the time of phonon relaxation during the phonon interaction with He^3 impurities. (28 refs.)

67.70 FILMS

(inc. physical adsorption)

67304 Singlet superfluidity in ^{3}He film on ^{4}He film. S.Kurihara (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1311-16 (April 1983).
It is predicted that spin-singlet superfluidity can be realized in a submonolayer ^{3}He film on the surface of thin film of superfluid ^{4}He. The basic mechanism of the superfluidity is the attraction between ^{3}He quasi particles arising from exchange of virtual third sound quanta. It is argued that the superfluid transition of ^{3}He film is of Kosterlitz-Thouless nature if the ^{4}He film is thick, and changes its nature as the ^{4}He thickness is reduced, with a crossover thickness of ~2 atomic layers. Several experiments are suggested to detect the new phase transition, to test whether the proposed mechanism is really working, and to examine the nature of the transition. The transition temperature is estimated to be in a temperature range attainable with a dilution refrigerator.

67305 Direct and thermal desorption of ^{4}He films. M.Sinvani, P.Taborek, D.Goodstein (California Inst. of Technol., Pasadena, CA, USA).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.59-62 (11 April 1983).
The authors have studied desorption from a ^{4}He film due to a hot but low-intensity beam of phonons incident from a sapphire substrate. Time of flight spectra of the desorbed atoms revealed two distinct peaks which they attribute to direct desorption by substrate phonons and to thermalization with subsequent desorption. (12 refs.)

67306 On the disappearance of superfluidity in helium films. G.Bannink. State Univ. Leiden, Netherlands thesis, 9 March 1983. Leiden, Netherlands: State Univ. Leiden (1983), 122 pp.
It has now been known for a long time that thin helium films retain superfluid transport properties down to thicknesses of only a few atomic layers. The mere occurrence of superfluidity in these almost two-dimensional systems presents a very fundamental problem, since the phenomenon of long-range order, believed to be responsible for the occurrence of superfluidity in bulk helium, cannot exist in two dimensions. The changes in superfluid properties on the film thickness are investigated. A thin-film oscillator, formed by two large film reservoirs connected by a long and narrow tube, is used to study both the mass transport properties and the third-sound phenomena. Both sets of data are analysed in the framework of a two-fluid model.

67.80 SOLID HELIUM AND RELATED QUANTUM CRYSTALS

67307 Quantum diffusion and recombination of atoms in a crystal at low temperatures. Yu.Kagan, L.A.Maksimov, N.V.Prokof'ev (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
JETP Lett. (USA), vol.36, no.6, p.253-6 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.204-7 (20 Sept. 1982). [received: April 1983]
The recombination kinetics of atoms in a crystal, when quantum sub-barrier diffusion is the limiting factor, is examined. The experimental results on recombination of atomic hydrogen in a molecular hydrogen matrix are analyzed. (4 refs.)

Infrared investigations with high sensitivity spectrometers: aspects of modern research .... See Entry 64967

Approaches for reducing the insulator-metal transition pressure in hydrogen .... See Entry 67451

68.00 SURFACES AND INTERFACES; THIN FILMS AND WHISKERS

(for impact phenomena, see 79.; for physics of crystal growth, see 61.50C; for corrosion, oxidation, and surface treatments, see 81.60)

68.10 FLUID SURFACES AND INTERFACES WITH FLUIDS

(inc. surface tension, capillarity, wetting and related phenomena)

67308 The contribution of hydrogen bonds to the surface tension of water. A.Luzar (Medical Faculty, Inst. of Biophys., Ljubljana, Yugoslavia), S.Svetina, B.Zeks.
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.485-90 (15 April 1983).
The surface energy, the surface free energy and the surface entropy of liquid water are calculated from the decrease in the number of hydrogen bonds in the surface layer, estimated on the basis of a simplified water structure scheme. In the calculations of the free energy density function only the hydrogen-bond interactions between molecules are taken into consideration. The resulting surface free energy of water is ≈43 mN/m at 25°C. The calculated temperature dependence is consistent with that observed. (18 refs.)

67309 The phases of insoluble monolayers: comparison between the surface pressure-molecular area (Π-A) diagram and shear modulus measurements. K.Miyano, B.M.Abraham (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA), J.B.Ketterson, S.Q.Xu.
J. Chem. Phys. (USA), vol.78, no.7, p.4776-7 (1 April 1983).
The authors have made a number of unusual observations which call into question the conventional interpretation of the surface pressure vs molecular area, the Π-A diagram. The data obtained on a series of long chain aliphatic alcohols $C_{18}OH$, $C_{20}OH$, $C_{21}OH$, and $C_{22}OH$, are currently being analyzed, but the observations are, they believe, of such a nature that the qualitative results merit reporting. The unique signature of a solid phase is the existence of a static shear modulus. They have designed an instrument that can measure a very small modulus in the presence of a high viscosity. (5 refs.)

67310 A study of the liquid-vapor interface of mercury: computer simulation results. M.P.D'Evelyn, S.A.Rice (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5081-95 (15 April 1983).
The paper extends their recently proposed pseudoatom theory for the liquid-vapor interface of simple metals to mercury. An important difference between mercury and the alkali metals is that in the former the metal-nonmetal transitions takes place over a range of density positioned at much higher density than the critical density. A modified pseudoatom model, with an improved treatment of the metal-nonmetal transition, is presented. Using the modified effective Hamiltonian for the ions, Monte Carlo simulations of the liquid mercury surface have been carried out. The simulations reveal a highly structured liquid-vapor transition zone, with large amplitude density oscillations. The metal-nonmetal transition is found to play a critical role in determining the liquid-vapor interface structure, and it gives rise to a partial monolayer of nonmetallic atoms adsorbed on the metal surface. A detailed comparison of their results with the existing experimental and theoretical work, particularly the X-ray reflectance data of Lu and Rice (1978), is presented. (86 refs.)

67311 Theory of electrolyte solution interfaces at finite dilution. M.A.Wilson, A.L.Nichols,III, L.R.Pratt (Dept. of Chem., Univ. of California, Berkeley, CA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5129-37 (15 April 1983).
The theory of dilute electrolyte solution interfaces is extended to treat higher concentration solutions. It is shown that the dominant initial higher concentration correction to the Onsager-Samaras results (1934) derive from solving the random phase approximation (RPA) for the salt concentration profiles in a satisfactorily self-consistent manner. Further, for conventional primitive solution surface models appropriate to dilute electrolyte solutions interfaces, it is shown that short-ranged non-Coulombic interionic interactions make a negligible contribution to the salt concentration profiles for bulk concentrations as high as a few tenths molar. Under these conditions the initial correction to the Onsager-Samaras absorption has a negative definite sign, so that the Onsager-Samaras surface tension will be less than the true surface tension for the primitive surface model treated. The theoretical results are compared with available computer simulation data. For the concentration range indicated, the agreement between these results is excellent. Finally, the authors provide a new analytical treatment of the RPA which is suitable for use at higher concentrations, and reduces to the Onsager-Samaras type results in the limit of infinite dilution. This improved treatment is obtained by analytically evaluating all integrals in the resulting RPA functional for a flexible category of troughlike trial concentration profiles. The choice of trial concentration profile is then determined by an optimization condition that the leading correction to the predicted interfacial absorption must vanish. (11 refs.)

67312 Contact angles between III-V melts and several substrates. U.Konig, W.Keck (Forschungsinst. Ulm, AEG-Telefunken, Ulm, Germany).
J. Electrochem. Soc. (USA), vol.130, no.3, p.685-6 (March 1983).
The wetting behavior of several melts with different III-V compound semiconductors is studied. The characteristic parameter measured is the contact angle of a melt drop with a solid. It is evaluated by a geometrical measurement of the melt drop. The importance of clean surfaces of drop and solid is shown. Contact angles between 20° and 60°C are found, depending on the type and composition of the melt and substrate. The temperature dependence amounts to about −4° per 100K in increase. In addition, the contact angle varies with the substrate orientation. The (100) oriented substrates are wetted better than (111)A oriented ones. (14 refs.)

67313 Measurement of the surface tension of gallium and indium in a hydrogen atmosphere by the sessile drop method. U.Konig, W.Keck (AEG-Telefunken, Forschungsinst. Ulm, Ulm, Germany).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.299-303 (April 1983).
Reports an evaluation of the surface tension σ of liquid gallium and indium in a palladium-diffused hydrogen atmosphere at temperatures up to 1150K. Small and large sessile drops of gallium have $\sigma(T_{MP})=680$ mJ m^{-2} at the melting point and a temperature dependence $d\sigma/dT=-0.091$ mJ m^{-2} K^{-1}. Large sessile drops of indium have $\sigma(T_{MP})=560$ mJ m^{-2} at the melting point and a temperature dependence $d\sigma/dT=-0.10$ mJ m^{-2} K^{-1}. (16 refs.)

67314 Continuous and first-order wetting transition from the van der Waals theory of fluids. E.H.Hauge (Inst. for Teoretisk Fysikk, Univ. i Trondheim, Trondheim, Norway), M.Schick.
Phys. Rev. B (USA), vol.27, no.7, p.4288-301 (1 April 1983).
The transition between incomplete wetting of an attractive substrate in contact with a gas at gas-liquid coexistence is studied. Within the framework of the systematic van der Waals (mean-field) theory of fluids, it is shown that both a continuous wetting transition, as found by Sullivan (1979, 1981), and a first order transition with a prewetting line, previously found by other methods, are possible. The relative magnitude of the various characteristic lengths in the problem is shown to be of relevance in this context. Beyond the model calculations, purely thermodynamic arguments show that in general the prewetting line, if it exists, joins the bulk coexistence line tangentially in the T-μ phase plane. The manner in which the difference in slope vanishes as bulk coexistence is approached is closely related to the nature of the forces. (25 refs.)

67315 Quantitative evaluation of the interfacial free energies at a solid-liquid lamellar eutectic interface. W.F.Kaukler (NASA, Marshall Space Flight Center, AL, USA), J.W.Rutter.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.305-13
The solid-liquid interfacial free energies of each of the individual phases comprising the eutectic system, carbon tetrabromide-hexachloroethane, were measured as a function of composition using a 'grain boundary groove' technique. Thermodynamic data were combined with groove shape measurements made from high resolution optical photomicrographs of the solid-liquid interfaces to give the interfacial free energy data. An interfacial free energy balance at the eutectic trijunction was performed to obtain all the forces acting on that point. The three interphase interfacial free energies at the eutectic trijunctions as well as a solid-solid phase boundary torque were evaluated. It was found that the solid-liquid interfacial free energies of the two phases of the eutectic could be evaluated from photomicrographs of growing or stationary eutectic interfaces. In addition, it was found that for a substantial range of freezing conditions the eutectic interface shape can be predicted from a knowledge of the interfacial free energies alone. (13 refs.)

Percolation cluster numbers and effective surface tension .... See Entry 64870

Water absorption by a solution of lithium bromide in wetted wall columns with tangential feed .... See Entry 66564

Instrument for measuring dynamic surface tension .... See Entry 66659

Evaporation of a highly superheated liquid .... See Entry 67173

Physicochemical properties, critical temperatures, and evaporation enthalpies of alkylalkoxysilanes and arylalkoxysilanes .... See Entry 67174

A pseudoatom theory for the liquid-vapor interface of simple metals: computer simulation studies of sodium and cesium .... See Entry 67179

Nucleate boiling in drag-reducing polymer solutions .... See Entry 67180

68.15 LIQUID THIN FILMS

67316 Recent advances in the LB film studies. M.Sugi, M.Saito, T.Fukui, S.Izima.
Solid State Phys. (Japan), vol.17, no.12, p.744-52 (Dec. 1982). In Japanese. [received: April 1983]
A summary is given of the recent advances in Langmuir film studies. The historical background and the basic concepts are also outlined. (45 refs.)

68.20 SOLID SURFACE STRUCTURE

67317 A theoretical inquiry into the question of W and Ta (100) atomic structures. G.Treglia (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), M.-C.Desjonqueres, D.Spanjaard.
J. Phys. C (GB), vol.16, no.12, p.2407-19 (30 April 1983).
In spite of the very large number of experiments (LEED, AES, UPS, MeV He^+ scattering, work function, FIM) carried out on W (100), no structural model consistent with all the data has been proposed yet: in particular, the question of the reconstruction thermally induced when the sample is cooled below room temperature remains a puzzling problem. Furthermore, from a theoretical point of view, no definitive answer has been given. Actually, either

the mechanism invoked for the reconstruction is too weak, or some contributions are omitted or calculated without sufficient care. The authors compute here the surface energy of W (100) taking into account the band term treated in the tight binding approximation, a pairwise repulsive potential of the Born-Mayer type and the electronic correlation contribution obtained from a perturbation treatment of the Hubbard model in the band limit. This energy is then fully minimised with respect to all coordinates of surface atoms, keeping all atoms neutral for any displacement. They find that the unreconstructed surface is the most stable at $T=0$K and discuss this unexpected result. A similar calculation for Ta (100) leads to opposite conclusions. (43 refs.)

67318 Glass surfaces—1982. L.L.Hench (Dept. of Materials Sci. & Engng., Univ. of Florida, Gainesville, FL, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.625-36 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A new category of glass surface is described. Type IIIB surfaces are composed of multiple layers of oxides, hydroxides, and hydrated silicates resulting from a sequence of solution-precipitation reactions between the glass surface and leaching solutions. Very low leach rates and then ion depletion depths of certain compositions of complex nuclear waste glasses are due to Type IIIB surfaces. The solubility limits that establish the equilibrium ionic concentrations for burial ground waters also establish the multiple barrier Type IIIB films, to protect nuclear waste glasses in contact with those ground waters. (43 refs.)

67319 Altered glasses: surface analysis study. J.H.Thomassin, P.Baillif, J.C.Touray (Dept. des Sci. de la Terre, Univ. d'Orleans, Orleans, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.637-40 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The study of the superficial composition of altered glasses has been investigated by XPS (or ESCA), secondary ion mass spectrometry (SIMS) and electron microscopes (TEM and SEM). The selected materials were industrial and natural glasses; the solutions were fresh water, sea-water and metal-bearing diluted solutions. The temperature was 90°C, the bulk was neither stirred nor replenished. All runs were performed on hand-fractured sections of glasses. Amongst the results obtained, one may quote the formation of a superficial Al-rich layer with an increase of Al into the hydrated underlying glass. Another result shows: (1) during the alteration in fresh water, the behaviour of iron and its influence on the alteration process can be related to the initial iron concentration; (2) in sea-water hydroxycarbonates were detected; these phases are the precursors of phyllosilicates characteristic of marine alteration of glasses. (9 refs.)

67320 Application of nuclear analysis methods to nondestructive measurements of concentration profiles of the surface region of glasses by aqueous leaching. P.Trocellier, C.Engelmann (DCAEA-SEA-SEAIN, CENS, Gif-sur-Yvette, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.641-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Nuclear analytical techniques based on direct observation of resonant reaction and charged particle backscattering are briefly described. Few depth profile examples concerning leached glasses are shown. (8 refs.)

67321 Direct analysis of the structure, concentration, and chemical activity of surface atomic vacancies by specialized low-energy ion-scattering spectroscopy: TiC(001). M.Aono, Y.Hou, R.Souda, C.Oshima, S.Otani, Y.Ishizawa (Nat. Inst. for Res. in Inorganic Materials, Ibaraki, Japan).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1293-6 (25 April 1983).
The structure, concentration, and chemical activity of atomic vacancies at the TiC(001) surface have been directly analyzed by specialized low-energy ion-scattering spectroscopy. It has been found that carbon vacancies are formed at the surface under a certain condition, and they capture oxygen atoms into the vacancy holes exhibiting a very high activity. (13 refs.)

67322 Ion beam crystallography of the Si(111)-(7×7) and (1×1) surfaces. R.M.Tromp, E.J.van Loenen, M.Iwami, F.W.Saris (FOM-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.779-80 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
New results have been obtained with Medium Energy Ion Beam crystallography on the structures of the Si(111)-(7×7) and on the laser irradiated Si(111)-(1×1) surfaces. The structures of both surfaces appear to be very similar. (3 refs.)

67323 Segregation of As on GaAs(110) surfaces observed immediately after cleavage. F.Bartels, H.J.Clemens, W.Monch (Lab. fur Festkorperphys., Univ. Duisburg, Duisburg, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.801-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A local excess of pure As was observed on surfaces cleaved from Te-, Si-, and Zn- doped boat-grown GaAs and from a sample fabricated by the travelling heater method. The surface segregation was studied by locally resolved Auger-electron and low-energy electron energy-loss spectroscopy. The diameter of the arsenic spots which varies up to 70 μm immediately after cleavage and the number of spots increase during storage at room temperature and by anneals at up to 170°C. With the larger spots a fine-structure is distinguishable. (8 refs.)

67324 New method for the analysis of reflection high-energy electron diffraction: α-Sn(001) and InSb(001) surfaces. I.Hernandez-Calderon, H.Hochst (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Phys. Rev. B (USA), vol.27, no.8, p.4961-5 (15 April 1983).
It is shown that from the analysis of intermediate Laue zones of a reflection high-energy electron diffraction pattern it is possible to determine the surface reconstruction in a definite way. The method of analysis is illustrated with the study of α-Sn(001) InSb(001) surfaces. The diamond-structured (α-) tin (001) surface exhibits a two-domain (2×1) reconstruction whereas for InSb(001) a $c(2\times8)$ reconstruction was obtained. These results are in contrast with the respective (2×2) and (2×4) reconstructions reported recently by Farrow et al. using the streak-separation method. (22 refs.)

67325 Atom-probe study of the initial stage of silicide formation. O.Nishikawa, Y.Tsunashima, E.Nomura, M.Wada, S.Horie, M.Shibata, T.Yoshimura, R.Uemori (Dept. of Materials Sci. & Engng., Tokyo Inst. of Technol., Yokohama, Japan).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.529-33 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The initial stage of silicide formation was investigated utilizing the high mass resolution atom probe. Silicon-deposited Ni and W specimen tips were heated to various temperatures in a vacuum of 10^{-7} Pa. A highly ordered image, which agreed well with the computer-simulated image of WSi_2 with the C11b structure, was observed after heating the tip to 950K. Ni formed a mixed layer with Si even at 80K. The depth profile of the silicide composition changed with temperature due to a high diffusibility of Ni. The silicide formed above 900K consistently showed a well-ordered image corresponding to a cubic structure, while its composition varied from Ni_3Si_2 to NiSi with depth. The computer-simulated image suggests that the observed ordered structure could be a modified Cl structure. The evaporation field of the ordered silicide was found to be significantly higher than those of pure Ni and Si, possibly due to a strong binding between the constituent atoms. (5 refs.)

67326 Stability and reactivity of (001) and (111) NiO: a RHEED-AES investigation of Si surface segregation and Ni formation by gas reduction. N.Floquet, L.-C.Dufour (Lab. de Recherches sur la Reactivite des Solides, Univ. de Dijon, Dijon, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.543-9 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
In this contribution are reported recent results regarding the preparation and the reactivity of different nickel oxide (NiO) monocrystalline surfaces. At first, it concerns a structural investigation of metal formation by hydrogen reduction of (001) NiO. In most cases, Ni nuclei form three-dimensional islands as observed by RHEED and corroborated by AES. At low temperatures, metal stacking, previously described as pure HCP stacking from {1120} planes, is shown to develop, in reality, with stacking faults from which FCC stacking is often formed. At high temperatures, metal stacking is retained as within the oxide and, from a comparative transmission electron microscopy investigation, a model for the topotactic nucleus formation is put forward. Secondly, the preparation and the stability of (111) NiO are investigated. Apparent (111) NiO stability is found to be due to the thermal surface segregation of silicon. Even in very low amount, this very mobile impurity segregates at the (111) NiO surface leading to a two-dimensional O-Si-Ni compound. (8 refs.)

67327 Defective nonplanar surfaces of MgO. E.A.Colbourn, J.Kendrick, W.C.Mackrodt (New Sci. Group, ICI plc, Runcorn, England).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.550-7 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Defect lattice and ab initio SCF calculations are reported for defective nonplanar surfaces of MgO. It is suggested that the concentrations of free vacancies and Ca^{2+} are much lower at nonplanar irregularities than at planar surfaces and in the bulk, whereas the levels of Li^+ and trapped holes are higher. The binding of H atoms and CO to three-coordinated corner sites is found to be appreciably higher than to the five-coordinated {001} surface. Thus it is concluded that calcium doping of MgO affects neither CO chemisorption nor the dissociative chemisorption of hydrogen whereas lithium doping influences both. (18 refs.)

67328 Ideally irregular surfaces, of dimension greater than two, in theory and practice. P.Pfeifer (Fakultat fur Chem., Univ. Bielefeld, Bielefeld, Germany), D.Avnir, D.Farin.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.569-72 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Applies Mandelbrot's [1977] concept of fractal (noninteger) dimension D to surfaces. The authors describe how surfaces can provide environments (e.g. for adsorbates) with $2\leq D\leq 3$. Conventional $D=2$ characterizes smooth surfaces; carriers of $D>2$ are 'ideally irregular' (self-similar) surfaces; and $D\rightarrow 3$ is obtained in the limit where a surface visits every point of a volume. The authors present three major methods to get D from experiment. Case studies give ample instances for well-defined $D>2$. Some eminent consequences are inferred. (8 refs.)

67329 A LEIS study of potassium enriched vanadium oxide surfaces. J.P.Landuyt, L.Vandenbroucke, R.de Gryse, J.Vennik (Lab. voor Kristallografie, Rijksuniv. Gent, Gent, Belgium).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.598-604 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
An important surface segregation of potassium to the $V_6O_{13}(001)$ surface is observed. From combined LEED and angular dependent LEIS experiments, it is found that the most probable K site at the $V_6O_{13}(001)$ surface is an interstitial site close to or within the topmost VO layer. It is furthermore shown that on V_6O_{13} the neutralization processes active in He^+ LEIS experiments can be described by the Hagstrum formalism. This result allows a semiquantitative estimation of the surface concentration. A model for the surface structure is presented. (15 refs.)

67330 Distribution of atoms in a ternary alloy with a free surface in the self-consistent field approximation. L.P.Grankina, V.I.Lozovoi, E.F.Ryzhkova, V.I.Ryzhkov (Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.8, p.721-5 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.47-52 (Aug. 1982). [received: April 1983]
Analytical form for the functions describing atomic distribution of the components in the subsurface layer of a ternary alloy has been found in a closed form in the self-consistent field approximation, without taking correlation into account. The functions obtained allow one to construct concentration profiles of the components near the surface, to calculate the component surface concentration, and to investigate the dependence of the composition on the surface of the alloy crystal on temperature, and surface relaxation of coordination numbers and energies of the nearest neighbor interatomic interaction in an alloy. An analysis of the character of temperature dependencies of the composition on the surface has been performed for various alloys. (7 refs.)

Ellipsometric studies of rough silicon surfaces .... See Entry 64942

Temperature dependence of the 00 LEED beam from the *X*-cut surface of α-SiO_2 .... See Entry 66786

Vacancy defects in GaAs:Sn .... See Entry 66985

Effect of pulse laser emission on mercuric telluride .... See Entry 67042

Stoichiometry effects at NiMo surfaces under bombardment with Ar^+ ions from 40 to 2000 eV .... See Entry 67062

Characterization by X-ray topography of subsurface deformation in abrasive wear .... See Entry 67334

SEXAFS studies of adsorbate structure on Si and Ge surfaces .... See Entry 67349

Aspects of chemisorption in partially ionic semiconductors .... See Entry 67351

GaAs (001)-$c(4\times4)$: a chemisorbed structure .... See Entry 67353

Drastic reduction of adsorption of CO and H_2 on (111)-type Pd layers .... See Entry 67356

LEED investigation of mixed layers of carbon and sulfur on cobalt .... See Entry 67358

The two state nature of H-induced W(100) reconstruction .... See Entry 67370

Nonuniformity in the deformation and substructure of epitaxial layers of $Mg_xMn_{1-x}Fe_2O_4/MgO$ .... See Entry 67391

Pore structure of amorphous silicon .... See Entry 67396

Surface mobility of silver and gold on evaporated silver bromide layers .... See Entry 67401

The atomic structure and electronic states of $GaAs_{1-x}P_x$ (110) .... See Entry 67714

Theory of semiconductor surface reconstruction: Si(111)-7×7, Si(111)-2×1, and GaAs(110) .... See Entry 67718

The interaction of hydrogen with surface states on GaAs(100) .... See Entry 67732

Surface properties of tin dioxide single crystals .... See Entry 67753

Electronic properties of gold-silicon (111) 7×7 interfaces .... See Entry 67781

Raman study of geometrical disorder at semiconductors surfaces .... See Entry 68207

Comment on 'Role of atomic-scale roughness in surface-enhanced Raman scattering .... See Entry 68229

Reply to 'Comment on "Role of atomic-scale roughness in surface-enhanced Raman scattering"' .... See Entry 68230

The effect of surface condition on the structure of the secondary emission spectrum of W(110) .... See Entry 68372

Studies of surfaces of materials using low energy ion beams .... See Entry 68384

A singularity in the interaction of high-energy singly-charged ions with a nonmetallic crystal surface .... See Entry 68395

Exploiting photon energy dependence in photoemission from Si(111)-Mo interface .... See Entry 68403

Photoemission from MBE grown III-V surfaces and interfaces .... See Entry 68406

Growth of epitaxial CdTe films in the $Cd(CH_3)_2$-$(CH_3)_2Te$-H_2 system .... See Entry 68453

Surface morphology during ion etching. The influence of redeposition .... See Entry 68677

Structural characterization of laser-processed molybdenum steel .... See Entry 68694

Diffractometer determination of the fine-structure parameters in surface layers of a material .... See Entry 68710

A spectroscopic method of determination of the perfection of the crystal structure of the surface of silicon sheets .... See Entry 68712

68.25 MECHANICAL AND ACOUSTICAL PROPERTIES OF SOLID SURFACES AND INTERFACES

(for tribology, see 62.20P and 81.40P)

67331 Acoustic surface waves in cubic crystals with overlayers. E.Sanz-Velasco, O.Hardouin Duparc, V.R.Velasco (Inst. de Fisica del Estado Solido, Univ. Autonoma de Madrid, Madrid, Spain).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.202-7 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Systems formed by semi-infinite cubic crystals with cubic overlayers, having (001) free surfaces and interfaces, are considered. The authors study the elastic surface waves of these systems, by using a Green function method, for arbitrary thickness and direction of propagation. Considerable simplification in the solution of the problem can be achieved for small thickness of the overlayer. In this limit they have obtained for the first time the dispersion relation of Rayleigh and Love waves in closed form, to first order in hK ($h\equiv$thickness, $K\equiv$parallel wavevector), for the symmetry directions [100] and [110]. They have studied several systems with $\eta>1$ and $\eta<1$ ($\eta=2C_{44}/C_{11}-C_{12}$). In this way the influence of the overlayer not only on the generalized Rayleigh waves (GRW) but also on the pseudo-surface waves (PSW) for several directions of propagation and different thickness of the overlayer, has been obtained. (11 refs.)

67332 Influence of a static electric field on the properties of Love surface waves in class 622 and 422 piezoelectric crystals. G.G.Kessenikh, L.A.Shuvalov (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1690-3 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2985-91 (Oct. 1982). [received: April 1983]
A theoretical study is made of the influence of a static external electric field E on the properties of Love surface waves in a system comprising a piezoelectric substrate made of class 622 or 422 crystals and an isotropic solid insulating layer, either 'soft' or 'hard'. It is shown that there are critical values of E for which Love waves can be formed. The dependence of the dispersion curves of these waves on E is examined. (6 refs.)

67333 Anomalous vibrational states of a monatomic surface film. A.S.Dolgov (N.E. Zhukovskii Kharkov Aviation Inst., Kharkov, Ukrainian SSR).
Sov. Phys. J. (USA), vol.25, no.7, p.598-600 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.22-5 (July 1982). [received: May 1983]
Vibrational states of a one-dimensional chain of atoms which models peculiarities of a monatomic surface film are considered. A set of nontrivial equilibrium states of the system is determined in whose vicinity almost linear band vibrations are possible. Peculiarities of anomalous branches of vibrational states are discussed. It is shown that the low-frequency gap of vibrational states disappears under certain conditions. This determines the possibility of appearance of low-frequency sound vibrations which are not possible for a trivial equilibrium distribution of atoms in the film. (4 refs.)

67334 Characterization by X-ray topography of subsurface deformation in abrasive wear. M.Rappaz, E.Blank (Lab. de Metall. Phys., Ecole Polytech. Federale de Lausanne, Lausanne, Switzerland).
Wear (Switzerland), vol.84, no.3, p.387-92 (1 Feb. 1983).
X-ray topography has been used to image the deformed subsurface zone in abraded dendritic alloys. This technique, which provides a direct means of characterizing this zone, is compared with optical microscopy. (13 refs.)

On the Bragg-diffraction of surface acoustic waves by acoustic grating .... See Entry 66415

The surface energy of zinc .... See Entry 67339

Scattering of volume magnetostatic spin waves by a surface acoustic wave .... See Entry 67988

68.30 DYNAMICS OF SOLID SURFACES AND INTERFACE VIBRATIONS

67335 Surface plasmons on gratings: coupling in the minigap regions. Y.J.Chen, E.S.Koteles, R.J.Seymour (GTE Labs. Inc., Waltham, MA, USA), G.J.Sonek, J.M.Ballantyne.
Solid State Commun. (USA), vol.46, no.2, p.95-9 (April 1983).
The authors present results of an experimental study of grating coupling to surface plasmons in minigap regions. These results are interpreted, qualitatively, in terms of grating coupling to coupled surface plasmon modes. The observed minigap sizes and the cancellations of the coupling oscillator strengths are related to the coupled mode matrix elements. (13 refs.)

67336 The dispersion relation of surface plasmons on rough surfaces; a comment on roughness data. H.Raether (Inst. fur Angewandte Phys., Univ. Hamburg, Hamburg, Germany).
Surf. Sci. (Netherlands), vol.125, no.3, p.624-34 (March 1983).
Surface plasmons (SP) having the maximum of their intensity in the surface are sensitive to geometric perturbations as roughness or gratings. This influence can be measured by the change of the dispersion relation of the SP. Whereas the results on sinusoidal gratings of Ag and Au can be calculated and agree with the observed results, the situation of statistically rough surfaces is less clear. An attempt is made to display the present situation. The experimental roughness data of 'smooth' (natural roughness) surfaces of silver films and of surfaces with enhanced roughness are collected and their consistency is discussed. There is agreement between the values of the RMS height, δ-5 Å, of 'smooth' vaporised silver films (about 500 Å thick) measured by different authors. The first-order theory describes the results in a satisfactory way. The situation of surfaces of Ag films of 500 Å thickness with enhanced roughness (underlayer of CaF_2), however, is not satisfying since the calculated data of the displacement of the dispersion curve and of the increase of the damping using second-order approximations of the field above the rough metal surface are smaller than the observed data. (41 refs.)

67337 Electronic damping mechanism for vibrations, rotations, and translations of adsorbates on metal surfaces. B.Hellsing, M.Persson, B.I.Lundqvist (Inst. of Theoretical Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.147-53 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Further theoretical evidence for the importance of the electronic mechanism for the energy exchange between an adsorbate and a metallic substrate is provided by first-principle calculations of the damping of vibrational modes of chemisorbed H and H_2 on free-electron-like metal surfaces and of the friction coefficient of an approaching H atom. In reactive situations, i.e. when a resonance in the adsorbate-induced electron structure crosses the Fermi level of the substrate conduction electrons, enhanced damping is exhibited. With rough estimates for rotational lifetimes added, relevant relaxation times for molecules approaching metal surfaces are briefly discussed. (22 refs.)

67338 Vibrational properties of Au and Pt(110) surfaces deduced from Rutherford backscattering data. D.P.Jackson, T.E.Jackman, J.A.Davies, W.N.Unertl, P.R.Norton (AECL, Chalk River Nuclear Labs., Chalk River, Ontario, Canada).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.226-35 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Rutherford backscattering measurements (RBS) of Pt(110) and Au(110) surfaces, both of which exhibit a (1×2) reconstruction, have been made over the temperature range 160-600K (Pt) and 150-1000K (Au). Angular scans about the [110] and [100] directions have been measured for the (1×2) phase on both materials. Detailed Monte Carlo simulation studies, including the effects of equal-time displacement correlations, have been used to interpret the vibrational properties of this surface phase. The Pt [110] surface peak data provide clear evidence that correlations of the atom vibrations exist and are consistent with those expected from bulk inelastic neutron scattering measurements. This was not the case for the Au[110] surface peak which exhibited higher yields than predicted. (18 refs.)

How can a particle absorb more than the light incident on it? .... See Entry 64611

Calculation of the phonon contribution to the specific heat of an overlayer-film substrate at low temperatures .... See Entry 67232

Vibrational excitations of hydrogen and oxygen on Pd(100) .... See Entry 67367

Infrared-laser-induced desorption by resonant multiphoton excitation of adsorbate vibration in CH_3F-NaCl at different coverages .... See Entry 67368

The two state nature of H-induced W(100) reconstruction .... See Entry 67370

Electronic and vibronic excitations of semiconductor surfaces studied by electron energy loss spectroscopy .... See Entry 67726

Two-dimensional Wigner lattice in a magnetic field and in the presence of a random array of pinning centers .... See Entry 67734

Nature of the active site in surface-enhanced Raman scattering .... See Entry 68209

Raman study of Ge and GaP microcrystals .... See Entry 68214

Ethylene on silver: development of surface enhanced Raman lines with exposure .... See Entry 68238

A novel technique for the identification of the surface plasmon in EELS .... See Entry 68375

Low energy electronic and vibronic excitations of semiconductor surfaces .... See Entry 68377

Adsorption site of oxygen chemisorption on Ni(110) at room temperature; an EELS study .... See Entry 68378

Low energy electron inelastic scattering at surfaces: application to Mg(0001) and (1100). I. The clean metal surfaces .... See Entry 68379

Thermal effects in UV photoemission from Cu(110) .... See Entry 68411

68.40 SURFACE ENERGY OF SOLIDS; THERMODYNAMIC PROPERTIES

67339 The surface energy of zinc. J.C.Bilello (Dept. of Materials Sci. & Engng., State Univ. of New York, Stony Brook, NY, USA), D.Dew-Hughes, A.T.Pucino.
J. Appl. Phys. (USA), vol.54, no.4, p.1821-6 (April 1983).
The influence of temperature and associated dislocation microstructure on the energies of basal plane cleavage in zinc crystals has been investigated using the method of Hull, Beardmore, and Valentine (HBV). A marked temperature dependence was observed in the zinc surface energy, over the range 77-298K, contrary to previous expectations. Plastic relaxation was associated with crack initiation at 77K, but not propagation; while at room temperature a plastic zone of 1200-1500 μm in depth was produced by crack extension. The surface energy could be estimated, independent of the usual Griffith analysis, by measuring the energy dissipation in a fully relaxed deformed zone associated with an explosively formed precursor crack. This method yielded surface energies of 0.066 to 0.079 J m^{-2} which was in good agreement with previous work. It is demonstrated that the cleaved surface energy of zinc is well below the thermodynamic surface energy and that this discrepancy is not related to plastic deformation. (26 refs.)

Thermodynamic interpretation of core-level binding energies in adsorbates ....See Entry 67742

Sputtering from binary alloys—a technique for evaluating change in surface binding energy ....See Entry 68386

68.45 SOLID-FLUID INTERFACE PROCESSES

(see also 82.65 Sorption and accommodation coefficients)

67340 SIMS-AES investigations on water vapour adsorption on nickel (100) at room temperature. K.Uhlmann, F.Storbeck, R.Griessbach (Sektion Phys., Tech. Univ. Dresden, Dresden, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.469-75 (1983).
By means of the methods SIMS and AES the adsorption of water vapour on the (100) surface of nickel was studied. The authors conclude from the results obtained that the adsorption has three stages: chemisorption of OH groups, formation of a surface hydroxide and finally, formation of an oxide layer containing O and OH. The quantity of oxygen detected corresponded at most to about a monolayer coverage. (17 refs.)

67341 Rotational cooling of rigid rotors desorbed from flat surfaces. J.M.Bowman, J.L.Gossage (Dept. of Chem., Illinois Inst. of Technol., Chicago, IL, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.481-4 (15 April 1983).
A simple model is presented for predicting the final rotational state distribution of an initially physisorbed rigid rotor. Based on the assumptions that the adsorbed rotor is freely rotating and that desorption occurs by a weak coupling between the rotational and desorbing degrees of freedom, a significant rotational 'cooling' is predicted. (21 refs.)

67342 The observation of one-phonon assisted selective desorption and adsorption of He atoms in defined vibrational levels on a LiF (001) single crystal surface. G.Lilienkamp, J.P.Toennies (Max-Planck-Inst. fur Stromungsforschung, Gottingen, Germany).
J. Chem. Phys. (USA), vol.78, no.8, p.5210-24 (15 April 1983).
By choosing the appropriate incident angle it has been possible to inject the nearly monoenergetic ($\Delta\nu/\nu \approx 1\%$)He atoms of an incident beam (18 meV) into one of the four bound states of the atom-LiF(001) surface potential. The final angular distributions of the atoms which have been inelastically scattered by phonons out of these bound states have been measured for the ⟨100⟩ and ⟨110⟩ directions of LiF (001). For the low-lying states these distributions are peaked at large final angles ($\approx 75°$) near grazing and are different from the distributions for the atoms directly inelastically scattered. The time of flight distributions indicated a predominance of annihilation events indicating that the atoms have been ejected by gaining the minimum amount of energy for release from the surface. The initial angle distribution of He atoms inelastically entering the $\langle 110\rangle \nu = 0$ ground state could also be measured by monitoring the flux at a unique magic angle at which the atoms can leave this state by the reverse of selective adsorption. The time of flight spectra reveal that the atoms in this case were trapped by a creation process. The two processes of adsorption and desorption are related by microscopic reversibility. The results are discussed in terms of a simple quantum resonance theory. (45 refs.)

67343 Theoretical studies of surface diffusion: A strategy of enhanced sampling. J.D.Doll, H.K.McDowell, S.M.Valone (Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5276-7 (15 April 1983).
Recent studies have demonstrated the feasibility and utility of numerical molecular dynamics simulation methods in the study of surface diffusion. Such methods have yielded surface diffusion constants which are in quantitative agreement with those measured by field ion microscope techniques. The authors describe an attempt to reduce the rather large computational effort involved in these studies by devising improved numerical sampling techniques. To test this point they have examined a set of molecular dynamics trajectories for single adatom surface diffusion on W(110). (9 refs.)

67344 Cluster studies of CO adsorption. III. CO on small Cu clusters. D.Post, E.J.Baerends (Scheikundig Lab., Vrije Univ., Amsterdam, Netherlands).
J. Chem. Phys. (USA), vol.78, no.9, p.5663-81 (1 May 1983).
For pt.II see Suf. Sci., vol.116, p.177 (1982). Chemisorption of CO on (100) and (111) Cu surfaces has been investigated by calculations on a series of small clusters. The dependency of the results on both the adsorption site (top or hollow) and the size of the cluster has been analyzed using a decomposition of the adsorption energy in various terms (steric repulsion, σ bonding, π backbonding). Some properties, i.e. M-CO distance, M-CO vibration, C-O distance, can be obtained from small cluster calculations as they are determined by 'local' bonding aspects, whereas, e.g. the adsorption energy is not reliable due to delocalized features of the bonding being not well represented by small clusters. The deficiency of small cluster in modeling the polarizability of a metal substrate is stressed. (52 refs.)

67345 The vibration spectrum of hydrogen bound by nickel catalysts. C.M.Sayers (Materials Phys. Div., AERE, Harwell, England).
J. Phys. C (GB), vol.16, no.12, p.2381-90 (30 April 1983).
The amplitude-weighted vibrational density of states of hydrogen adsorbed on nickel (100) and (111) surfaces is computed and compared with inelastic neutron scattering data on nickel catalysts. Local modes at 113 meV and 140 meV are interpreted as being due to vibrations of hydrogen parallel and perpendicular to the surface at a three-coordinated site respectively. A peak at 80 meV is interpreted as arising from vibrations of hydrogen perpendicular to the surface at a four-coordinated site. The relative intensities of the local modes in the data suggest that the three-coordinated site is the preferred site for adsorption on nickel catalysts. However the measured density of states below 300 cm^{-1} indicates some occupancy of four-coordinated sites in agreement with the existence of a peak at 80 meV. (20 refs.)

67346 Electronic criteria for distinction between weak and strong ionosorption. A.Luyckx (Lab. de Phys.-Chimie, Univ. Catholique de Louvain, Louvain-la-Neuve, Belgium).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.559-63 (1983).
Three different types of ionosorption on pellets of compressed powder of cobaltous oxide have been observed by measurements of the electrical conductance. (a) When a powder is efficiently outgassed, an instantaneous ionosorption of oxygen is characterised by an increase in conductance, while a sudden decrease of conductance appears when hydrogen is introduced instead of oxygen. (b) A slow change of conductance starts, less than an hour after the first phase of instantaneous ionosorption, and goes on during several days. A parallel shifting of the semilog straight lines of the resistance vs. absolute temperature, has generally been observed below a threshold temperature of 85°C. (c) Beyond this threshold of temperature, a simultaneous shifting and revolving of the semilog lines has been established. Their slopes increase in hydrogen and decrease in oxygen ambience. Water vapor was detected at and beyond this threshold. This temperature, beyond which the revolving starts, is the same for hydrogen, oxygen or carbon monoxide ambience. The parallel shifting of the semilog lines and the meaning of the threshold of 85°C has been interpreted following two possible assumptions. (9 refs.)

67347 Study of gas relative permeability in a mesoporous alumina pellet. N.K.Kanellopoulos, J.H.Petropoulos (Phys. Chem. Lab., Demokritos Nuclear Res. Centre, Athens, Greece).
J. Chem. Soc. Faraday Trans. I (GB), vol.79, no.2, p.517-25 (Feb. 1983).
The helium relative permeability of an alumina mesoporous pellet partially blocked by sorbed CCl_4 has been studied on both sorption and desorption branches of the sorption isotherm. The plot of relative permeability (P_R) against the amount of CCl_4 sorbed (ν_s) is concave upwards; this is in contrast to the initially convex upwards curve reported previously for microporous Carbolac carbon containing paraffin sorbates, but in agreement with some preliminary computations based on a capillary-network model. Differences between the P_R against ν_s plots for the sorption and desorption branches of the isotherm are not significant in relation to the repeatability of the results. (14 refs.)

67348 Theory of chemisorption on surfaces of ferromagnetic metals. H.Kasai, A.Okiji (Dept. of Appl. Phys., Osaka Univ., Osaka, Japan), A.Yoshimori.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.22-4 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The effect of electron correlation on the surfaces of ferromagnetic metals and chemisorbed atoms on them is investigated within the alloy analogy of the Hubbard second approximation. It is shown that the presence of surfaces diminishes local magnetic moments and that adatoms may have a similar effect. (10 refs.)

67349 SEXAFS studies of adsorbate structure on Si and Ge surfaces. P.H.Citrin, J.E.Rowe, P.Eisenberger, F.Comin (Bell Labs., Murray Hill, NJ, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.786-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Surface extended X-ray absorption fine structure studies of Cl, L, and Te adsorbed on Si and Ge surfaces reveal in some cases unexpected adsorption site variations and bond lengths. Iodine and chlorine occupy the atop site on both Si{111}7×7 and Ge{111}2×8 whereas Te occupies two distinct and previously unreported bridging sites on these surfaces. The Cl site identification on Si{111}7×7 is consistent with previously reported UPS and theoretical work whereas on Ge{111}2×8 it is not. Comparison between surface and bulk bond lengths suggests π bonding for Si surface atoms. (10 refs.)

67350 Chemisorption and electronic charge transfer at ionic semiconductor surfaces. W.Gopel (Phys. Dept., Montana State Univ., Bozeman, MT, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.789-91 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Effective charges attributed to surface atoms at single crystal polar or nonpolar surfaces of ionic semiconductors are unchanged only by less than one percent as compared with bulk values. Formation of intrinsic point defects or extrinsic chemisorption-induced defects, however, may lead to significant charge redistribution and hence to significant changes in core-level binding energies as well as valence band features. The energies relative to the Fermi energy of uppermost occupied electronic states attributed to neutral, negative, and positive adsorption complexes determine the direction of an additional delocalized charge exchange between free electrons in the semiconductor and defects or adsorption complexes. (5 refs.)

67351 Aspects of chemisorption in partially ionic semiconductors. C.Calandra (Istituto di Fisica, Univ. di Modena, Modena, Italy).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.804-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A review is presented of some recent results about the electronic and structural properties of chemisorbed species on III-V semiconductor surfaces. The chemisorption of hydrogen and group V elements on GaAs (110) surface is discussed in detail. (27 refs.)

67352 Transitions of an internal degree of freedom within an incommensurate phase. J.L.Cardy, M.P.M.den Nijs, M.Schick (Dept. of Phys., Univ. of Washington, Seattle, WA, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4251-5 (1 April 1983).
The authors consider molecules which are adsorbed on a substrate in either a commensurate or a floating-solid phase and which exhibit a transition due to the ordering of an internal degree of freedom. They show that the thermodynamic singularities associated with the transition in the floating-solid phase, below the dislocation-unbinding temperature, are the same as in the commensurate phase. This contrasts with the expected difference in the wave-vector singularities of the scattering response function. The case of orientational ordering in N_2 adsorbed on graphite is treated explicitly . They also note that in cases in which the interaction between the internal degrees of freedom is strong, the melting of the floating-solid phase can be significantly altered. (20 refs.)

67353 GaAs (001)-*c*(4×4): a chemisorbed structure. P.K.Larsen (Philips Res. Labs., Eindhoven, Netherlands), J.H.Neave, J.F.van der Veen, P.J.Dobson, B.A.Joyce.

Phys. Rev. B (USA), vol.27, no.8, p.4966-77 (15 April 1983).

The authors have carried out an experimental study of the As-stable GaAs(001)-*c*(4×4) reconstruction using a combination of molecular-beam epitaxy with reflection electron diffraction, angle-resolved photoemission, and surface-sensitive core-level photoemission. (The measurements were performed at Laboratoire pour l'Utilisation du Rayonnement Electromagnetique, Universite Paris-Sud, Orsay, France). Apart from the surface symmetry, the electron diffraction data show one-dimensional disorder along the [110] direction, probably corresponding to a corrugated-sheet structure in reciprocal space. photoemission from surface states having dangling-bond character shows a one-fold periodicity and an energy dispersion of 0.65 eV along [110], while along [110] the dispersion is much smaller but there is a doubling of the periodicity. Observations of the As 3*d* and Ga 3*d* core levels show a surface As 3*d* component at 0.62 eV higher binding energy than the bulk component, indicative of As-As bonding. The Ga 3*d* surface core-level shift is very small and the line shape is similar to that from the (2×4) surface. The experimental results can be understood on the basis of an As overlayer structure, for which they propose specific models derived from trigonally bonded chemisorbed As. (35 refs.)

67354 Theory of photodesorption of molecules by resonant laser-molecular vibrational coupling. Z.W.Gortel, H.J.Kreuzer (Dept. of Phys., Dalhousie Univ., Halifax, Nova Scotia, Canada), P.Piercy, R.Teshima.

Phys. Rev. B (USA), vol.27, no.8, p.5066-83 (15 April 1983).

Photodesorption due to a laser resonantly coupled into an internal vibrational mode of an adsorbed molecule is considered. Based on a master equation with transition probabilities calculated quantum statistically for laser-induced vibrational transitions, phonon-mediated bound-state-bound-state and bound-state-continuuum transitions, and tunnelling transitions from bound states degenerate with the continuum, the authors calculate desorption rates as a function of temperature and laser intensity. They are highly nonlinear in both, and become saturated for high intensities. The theory is applied to the CH_3F-NaCl and CO-NaCl systems. (28 refs.)

67355 Electronic friction and covalent chemisorption. K.Schonhammer (I. Inst. fur Theoretische Phys., Univ. Hamburg, Hamburg, Germany), O.Gunnarsson.

Phys. Rev. B (USA), vol.27, no.8, p.5113-15 (15 April 1983).

The energy loss to low-energy electron-hole pairs in the process of sticking at metal surfaces is discussed for atoms or molecules which form a covalent chemisorption bond. Using the Friedel sum rule it is shown that a different symmetry behavior of the highest occupied molecular orbital and the lowest unoccupied molecular orbital is favorable for larger electronic friction. (22 refs.)

67356 Drastic reduction of adsorption of CO and H_2 on (111)-type Pd layers. H.Poppa, F.Soria (Stanford NASA Joint Inst. for Surface & Microstructure Res., NASA Ames Res. Center, Moffett Field, CA, USA).

Phys. Rev. B (USA), vol.27, no.8, p.5166-8 (15 April 1983).

Clean surfaces of (111)-type Pd layers, grown from the vapor phase on Mo(110) at room temperature, were used to study the adsorption of CO and H_2 by temperature-programmed desorption, Auger electron spectroscopy, and low-energy electron diffraction. Mild annealing of the as-grown layers during a single desorption cycle (to about 600K) drastically reduces the adsorption for both adsorbates. Low-dose argon-ion bombardment introduces surface imperfections which restore a high adsorption probability. The results are interpreted in terms of particular (111)-type surface structures that persist to layer thicknesses of about four monolayers, the results raise questions with respect to the surface structure of supported thin epitaxial islands and particles of Pd and possibly also with respect to conventional methods of preparing bulk surfaces of Pd for adsorption studies. (13 refs.)

67357 Dissociation of water molecules on Si surfaces. S.Ciraci, H.Wagner (Inst. fur Grenzflachenforschung und Vakuumphys., KFA Julich, Julich, Germany).

Phys. Rev. B (USA), vol.27, no.8, p.5180-3 (15 April 1983).

Molecularly adsorbed water is weakened due to the chemisorption bond between oxygen and surface silicon and has a Fermi level lying in the conduction band. This unstable binding structure dissociates to yield a lower-energy configuration. Binding structures that may result from the dissociation in the temperature range from 300 to 750K are discussed. With state-density calculations it is demonstrated that a dissociative binding structure, in which OH and H are chemisorbed to closely lying surface silicon atoms, accounts for the room-temperature ultra-violet photoemission spectrum. (14 refs.)

67358 LEED investigation of mixed layers of carbon and sulfur on cobalt. M.Maglietta, A.Fallavollita, G.Rovida (Univ. di Firenze, Firenze, Italy).

Solid State Commun. (USA), vol.46, no.3, p.273-6 (April 1983).

The structure of mixed layers of carbon and sulfur on the Co(001) face was investigated by LEED as a function of composition. The results indicate that C and S atoms do not form separate islands, but are present in the same domains on neighbour sites. Several models are discussed, on the basis of the structure of the pure phases $c(2\times2)-S$, $p(2\times2)-S$ and $p(2\times2)-C$ on Co(001), which are shown to be nearly the same as those reported for the Ni(001) face. (9 refs.)

67359 Temperature induced structural changes for coadsorbed H and CO on Ni(100). H.C.Peebles, D.E.Peebles, J.M.White (Dept. of Chem., Univ. of Texas, Austin, TX, USA).

Surf. Sci. (Netherlands), vol.125, no.3, p.L87-92 (March 1983).

Low energy electron diffraction (LEED) data are reported which show interesting changes with temperature in the structure of carbon monoxide adsorbed on hydrogen-presaturated Ni(100). These results are compared with vibrational and electron spectroscopy data, and some structural models are proposed. (10 refs.)

67360 Adsorption of N_2 and NH_3 on Mo(111). C.Egawa, S.Naito, K.Tamaru (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan).

Surf. Sci. (Netherlands), vol.125, no.3, p.605-12 (March 1983).

The surface structure of the Mo(111) plane in the adsorption of N_2 and NH_3 has been investigated by means of low energy electron diffraction (LEED). The adsorption of N_2 and NH_3 at room temperature shows no extra new LEED spots except for an increase of the background intensity. Heating of this surface to 850K or higher caused faceting of the (111) surface to produce the (443) face of molybdenum. On this surface only nitrogen atoms are adsorbed; it exhibits the c(3×2) in-registry overlayer structure of the (443) face from the low nitrogen coverage to the saturated one, 0.35, which is determined by the nitrogen Auger intensity. This saturated coverage is consistent with the surface coverage of the c(3×2) overlayer structure (0.33). The sticking coefficient of N_2 adsorption is about 0.05 and it is constant irrespective of the coverage, which suggests island formation of superstructure on the surface. On the other hand, the sticking coefficient at room temperature is only slightly larger than at 850K. Photoemission spectra obtained from He I or He II also revealed the same atomic nitrogen level at about 5 eV, indicating that the electronic state of the nitrogen atoms is the same at both temperatures. (8 refs.)

67361 The adsorption study of tellurium on iron (001) surface by means of LEED, AES and $\Delta\phi$. S.Nakanishi, T.Horiguchi (Dept. of Phys., Univ. of Osaka Prefecture, Sakai, Japan).

Surf. Sci. (Netherlands), vol.125, no.3, p.635-52 (March 1983).

A study of tellurium adsorption onto the iron single crystal (001) surface has been made by means of LEED, AES and $\Delta\phi$ techniques. LEED observations showed the formation of p(2×2), c(2×2), and the antiphase domain structures (associated with these structures at low coverages ($\theta<0.7$)). The results of the Auger study revealed the layer growth of adatoms, which was characterized by pronounced linear segments in Auger uptake curves. The work function change was also measured. It showed monotonous increase at low coverage ($\theta<0.5$) followed by a subsequent maximum and minimum at further coverages ($\theta<0.7$). The details of this behavior were discussed in connection with the LEED and AES results. (21 refs.)

67362 Angular resolved flash desorption of carbon monoxide from tungsten (100). D.R.Horton, R.I.Masel (Dept. of Chem. Engng., Univ. of Illinois, Urbana, IL, USA).

Surf. Sci. (Netherlands), vol.125, no.3, p.699-708 (March 1983).

Carbon monoxide desorption from tungsten (100) is studied using angular resolved thermal desorption spectroscopy. The flux of α-CO is found to vary as $\cos\theta$, where θ is the angle between the surface normal and the detector centerline, while the flux of β_1-CO is found to vary as $\cos^4\theta$, the flux of β_2-CO is found to vary as $\cos^3\theta$ and the flux of β_3-CO is found to vary as $\cos\theta$ or $\cos^2\theta$. These results suggest that there are rearrangements of the tungsten surface during desorption of β-CO. It is suggested that these arrangements create the three-peak β structure normally observed. The data demonstrate that absorption and desorption are not necessarily related by microscopic reversibility when the adsorption and desorption temperatures are different. (16 refs.)

67363 Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). I. TPD, $\Delta\phi$, and UPS studies. B.E.Koel, D.E.Peebles, J.M.White (Dept., of Chem., Univ. of Texas, Austin, TX, USA).

Surf. Sci. (Netherlands), vol.125, no.3, p.709-38 (March 1983).

Ultraviolet photoemission (UPS), work function change ($\Delta\phi$) and temperature programmed desorption (TPD) data are reported for carbon monoxide and hydrogen coadsorbed in Ni(100). Predosed hydrogen and postdosed carbon monoxide are intimately mixed and strongly coupled on Ni(100) at 100K, but there is no evidence for direct C-H or O-H bonding. TPD shows sharp desorption peaks of both CO and H_2 around 210K (Σ states). UPS shows that a single type of weakly adsorbed CO, Σ-CO, exists on an H-presaturated Ni(100) surface at 100K. This species is irreversibly converted to β-CO after heating to 260K to desorb some CO and H_2. The chemical bonding of the adsorbed CO changes significantly with the conversion from Σ to β-CO. Work function measurements show that the surface dipole associated with Σ-CO is nearly zero. The results suggest that Σ-CO has an electronic structure readily derivable from chemisorbed CO perturbed by a through-Ni interaction with hydrogen bonded to the same Ni atom or atoms. (94 refs.)

67364 Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). II. ELS and XPS studies. B.E.Koel, D.E.Peebles, J.M.White (Dept. of Chem., Univ. of Texas, Austin, TX, USA).

Surf. Sci. (Netherlands), vol.125, no.3, p.739-61 (March 1983).

For pt.I see ibid., vol.125, no.3, p.709 (1983). Electron energy loss spectroscopy (ELS) and X-ray photoelectron spectroscopy (XPS) have been used to characterize CO adsorbed alone and coadsorbed with hydrogen on Ni(100) at low temperatures. Evidence is presented for a significantly weaker bond between CO and the substrate in the presence of coadsorbed hydrogen as compared to CO adsorbed alone. This is reflected by a growth of satellite intensity and a shift to higher binding energy of XPS C(1s) and O(1s) core lines when hydrogen is present. The ELS data show that the splitting between the $2\pi_b$ and $2\pi_a$ levels decreases when hydrogen and CO are coadsorbed. (54 refs.)

67365 Molecular orbital study of CO chemisorption on a Pt(111) surface in the presence of potassium. N.K.Ray, A.B.Anderson (Chem. Dept., Case Western Reserve Univ., Cleveland, OH, USA).

Surf. Sci. (Netherlands), vol.125, no.3, p.803-12 (March 1983).

A molecular orbital study was made, using an atom superposition and electron delocalization (ASED) technique, to examine the chemisorptive properties of CO on a Pt(111) surface in the presence of coadsorbed potassium atoms. To understand the effect of preadsorbed K on CO chemisorption, the authors have studied the adsorption of K on a cluster model of a Pt(111) surface. K is predicted to be preferentially adsorbed at a three-fold position and the calculated binding energy is in reasonable agreement with other estimates. K adsorption is found to lead to a significant charge transfer which in turn increases the electron density of all surface Pt atoms. The presence and increasing coverage of K on the Pt(111) surface has been simulated by decreasing the valence state ionization potential of Pt atoms in the cluster models. With the decreasing values (i.e. with increasing K coverage), the CO molecule is predicted to change its site of occupation from a one-field position to the two-fold or three-fold positions. The CO stretching force constant is predicted to decrease for all the sites with decreasing VSIP values of Pt. They find the decrease in CO force constant on going from the one-fold to two-fold site is smaller than the decrease on going from the one-fold to three-fold site. (23 refs.)

67366 Chemisorptive properties of Pt-Ni(111) single crystal alloys with high platinum content: C_2H_4 and C_6H_6 adsorption. J.Massardier, B.Tardy, M.Abon, J.C.Bertolini (Inst. de Recherches sur la Catalyse, CNRS, Villeurbanne, France).

Surf. Sci. (Netherlands), vol.126, no.1-3, p.154-62 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).

The chemisorption of ethylene and benzene has been investigated on $Pt_{78}Ni_{22}$ and $Pt_{50}Ni_{50}$(111) single crystal alloys by vibrational electron energy loss spectroscopy and thermal desorption spectroscopy. These alloys exhibit a strong platinum segregation leading to a quasi-complete platinum layer on the surface. On $Pt_{78}Ni_{22}$(111), the hydrocarbonated surface complexes formed after C_2H_4 and C_6H_6 adsorption show the same main features as these recorded on Pt(111). However, evidence for more weak interactions with the metal surface is obtained. On $Pt_{50}Ni_{50}$(111), no C_2H_4 and C_6H_6 adsorption has been obtained, even at 180K. These results evidence the specific behaviour of the superficial layers of quasi-pure platinum supported on the bulk alloys with respect to pure platinum: a decrease of chemisorption strengths is observed after alloying, which is much more pronounced on the $Pt_{50}Ni_{50}$ sample. (19 refs.)

67367 Vibrational excitations of hydrogen and oxygen on Pd(100). C.Nyberg, C.G.Tengstal (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.163-9 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Angle resolved high resolution electron energy loss spectroscopy (EELS) and low energy electron diffraction (LEED) has been used to study the adsorption of hydrogen and oxygen on Pd(100). Hydrogen adsorbs dissociatively at all temperatures studied ($T>10$K) and nucleates into c(2×2) islands for $T<260$K. A dipole excited loss at 64 meV is observed and is attributed to atomic adsorption in the hollow site somewhat above the Pd surface. Oxygen is dissociatively adsorbed at room temperature and forms a p(2×2) structure. A vibrational mode at 44 meV is detected implying adsorption in the hollow position. At low temperature ($T<110$K) both atomic and molecular adsorption occurs. A loss at 90 meV is assigned to the intramolecular stretch vibration of associatively adsorbed oxygen. Coadsorption of oxygen and hydrogen at low temperature ($T\simeq80$K) yields a disordered overlayer. Raising the temperature caused ordering and redistribution of the overlayer. Finally at 300K, hydrogen and oxygen reacts to form water which desorbs from the surface. (10 refs.)

67368 Infrared-laser-induced desorption by resonant multiphoton excitation of adsorbate vibration in CH_3F-NaCl at different coverages. J.Heidberg, H.Stein, E.Riehl (Inst. fur Phys. Chem. und Elektrochem., Univ. Hannover, Hannover, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.183-91 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Desorption induced by resonant CO_2 laser pulses in CH_3F-NaCl(film) on NaCl(100) single crystal surfaces at different coverages has been observed. The primary acctivation step is the multiphoton excitation of the most intense internal adsorbate vibration, the C-F stretching mode ν_3. The variation of desorption yield with laser frequency was measured at constant fluence and coverage and was correlated with the corresponding linear absorption spectra. From desorption yield versus laser fluence plots, rate coefficients and characteristic minimum energy fluence values ϕ_s for desorption at different surface coverages have been determined, showing increasing ϕ_s with decreasing coverage at constant excitation frequency. By appropriate choice of laser frequency and fluence, it is possible to separate different adsorption phases by desorption. (15 refs.)

67369 Preferential orientation of formic acid adsorbed on Al oxides. M.Liehr, S.Ewert (II. Phys. Inst., Rheinisch-Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.208-13 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The vibrational spectra of HCOOH (DCOOD) molecules adsorbed on Al oxide tunnel barriers are studied by inelastic electron tunneling spectroscopy. The (Al/Al oxide/Pb) tunnel junctions are prepared in situ in an ultrahigh vacuum cryostat. It is concluded that the format adsorbs with a preferred orientation on microcrystalline Al oxide, whereas on amorphous Al oxide there is a rather random orientation. (15 refs.)

67370 The two state nature of H-induced W(100) reconstruction. E.F.J.Didham, W.Allison, R.F.Willis (Dept. of Phys., Univ. of Cambridge, Cambridge, England).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.219-25 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The authors present electron energy loss analysis of the hydrogen induced commensurate-incommensurate displacive phase transition on the W(100) surface. Coverage dependent results indicate that the transition from the $(\sqrt{2}\times\sqrt{2})$ to the (1×1) phase occurs via a tilted dimer model for the intermediate incommensurate phase. The combination of both lateral and vertical shafts of the substrate W atoms is indicative of mixing between two lattice vibrational modes: the Rayleigh branch with displacements normal to the surface plane, and a phonon branch with displacements parallel to the surface. The temperature dependent results clearly provide evidence for both states which play an important role in order-disorder (particularly) and first order (possibly) phase transitions. (15 refs.)

67371 SO_2 adsorption and desorption kinetics on Pt(111). U.Kohler, H.-W.Wassmuth (Fachbereich Phys., Univ. Marburg, Marburg/Lahn, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.448-54 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
SO_2/Pt(111) adsorption and desorption kinetics in the temperature range 160-300K were investigated by a molecular beam technique and TDMS measurements. The initial sticking probability $s_{SO(2)}{}^0$ turns out to be unity independent of surface temperature, and the $s_{SO(2)}(\theta)$ curves indicate the operation of a precursor mechanism. The TDMS spectra of SO_2 could be analysed by means of second order desorption kinetics indicating that SO_2 seems to be adsorbed dissociatively even at low temperatures (at least for small coverages). The resulting kinetic parameters are interpreted as values determining the recombination process $(SO)_{ad}+O_{ad}\rightarrow(SO_2)_{ad}$, assuming the SO_2 molecule to desorb directly. Combining these results with those on SO dissociation and recombination, it was possible to construct a potential energy diagram for sulfur-oxygen reactions on Pt(111). (13 refs.)

67372 Chlorine and iodine adsorption on the Ta(100) and Ta(110) surfaces. Z.T.Stott, H.P.Hughes (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.455-62 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The interaction of chlorine and iodine with the Ta(100) and Ta(110) surfaces, the two most densely packed BCC planes, has been investigated using LEED and Auger electron spectroscopy. Both halogens are readily adsorbed at room temperature. It appears that adsorption occurs dissociatively, via a mobile precursor state, with high initial sticking probability. LEED indicates that room temperature adsorption on the Ta(100) surface is disordered while both surfaces form series of temperature and coverage dependent phases above room temperature. The decrease in work function noted during chlorine and iodine adsorption on the Ta(110) surface is discussed and compared with other halogen systems which show a similar unexpected decrease. Characteristic energy loss peaks in the region 8 to 50 V below the elastic peak have been investigated and peak assignments made for both clean and halogen covered surfaces. (26 refs.)

67373 Effect of the repulsion between adsorbed atoms on their diffusion on the surface of a crystal. A.A.Tarasenko, A.A.Chumak (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1683-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2972-7 (Oct. 1982). [received: April 1983]
The diffusion coefficient of adsorbed atoms (adatoms) with a repulsive adatom-adatom interaction is calculated in the self-consistent field approximation. It is shown that the diffusion coefficient changes discontinuously at phase transition points of the system of adatoms (transitions between disordered and ordered states or transitions between different ordered states). Such a dependence of the diffusion coefficient on the adatom concentration is due to a change in the interaction of adatoms with their surroundings which takes place during a phase transition in a system of adatoms. (5 refs.)

67374 Molecular orbital study on the interaction of Ni and Cu atoms with oxygen-containing organic ligands and its implication to adsorption. H.Itoh (Inst. of Phys. & Chem. Res., Saitama, Japan).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.477-82 (April 1983).
The interactions of Ni and Cu atoms with CH_3OH and H_2CO ligands were studied by means of ab initio MO calculations. The metal atom-ligand bond length is shorter for Ni than for Cu. Correspondingly, the binding energy is larger for Ni than for Cu. The difference in adsorptive properties of Ni and Cu is explained by the difference in their electronic structures. Alloying effects are discussed. The interaction of the Cu atom with the CH_3O radical is also calculated. (34 refs.)

Quantum dynamical model of laser-stimulated isotope separation of adsorbed species: role of anharmonicity, coupling strength, and energy feedback from the heated substrate .... See Entry 66148

Recent advances in the LB film studies .... See Entry 67316

Defective nonplanar surfaces of MgO .... See Entry 67327

Anomalous vibrational states of a monatomic surface film .... See Entry 67333

Electronic damping mechanism for vibrations, rotations, and translations of adsorbates on metal surfaces .... See Entry 67337

Pore structure of amorphous silicon .... See Entry 67396

Applications of surface polaritons for vibrational spectroscopic studies of thin and very thin films .... See Entry 67479

The diamond (111) surface: a dilemma resolved .... See Entry 67723

The interaction of hydrogen with surface states on GaAs(100) .... See Entry 67732

Observation of nonuniform energy band shifts for Ge on GaAs(100) .... See Entry 67733

Electronic structure evolution of Pd overlayers on Cu .... See Entry 67738

Thermodynamic interpretation of core-level binding energies in adsorbates .... See Entry 67742

Electronic excitations in K monolayer adsorbed on Si(100) 2×1 .... See Entry 67743

Charge carrier escape rate from electrode-liquid interface .... See Entry 67754

Formation of high asymmetric oxide tunnelling barriers on niobium and tantalum .... See Entry 67805

Change in electrophysical properties of PbTe thin films under the action of oxygen .... See Entry 67819

Anomalous temperature dependence of CdS film conduction due to oxygen diffusion and chemisorption .... See Entry 67822

Optical constants and thermal radiative properties of CO_2 cryodeposit .... See Entry 68147

Surface-enhanced Raman study of the solid/liquid interface: conformational changes in adsorbed molecules .... See Entry 68190

Nature of the active site in surface-enhanced Raman scattering .... See Entry 68209

Competition among adsorbed species for surface sites on Ag electrodes as determined by SERS .... See Entry 68236

The adsorption of CO on Pt(111) studied by infrared reflection-adsorption spectroscopy .... See Entry 68237

Ethylene on silver: development of surface enhanced Raman lines with exposure .... See Entry 68238

Large-angle electron-energy-loss spectroscopy with the inclusion of a surface image potential .... See Entry 68373

EELS identification of the adsorbed species from acetone adsorption on Pt(111) .... See Entry 68376

Adsorption site of oxygen chemisorption on Ni(110) at room temperature; an EELS study .... See Entry 68378

Diffraction of He atoms from a Xe overlayer adsorbed on graphite (0001) .... See Entry 68391

Comment on 'X-ray photoelectron spectroscopic studies of oxygen chemisorption on thick films of photoconducting cadmium sulfide' .... See Entry 68398

Physisorption on a low work function metal: ARUPS from xenon on cesium .... See Entry 68408

XPS and UPS study of Pb monolayers on polycrystalline Pd .... See Entry 68409

Valence level photoelectron spectroscopy of the oxygen and carbonate species on silver (110) .... See Entry 68410

C(1s) spectroscopy of hydrocarbons adsorbed on Pt(111) .... See Entry 68412

Initial stages of the oxidation of zirconium studied by X-ray photoelectron spectroscopy and secondary-ion mass spectroscopy .... See Entry 68697

Esters dissociatively adsorb on alumina .... See Entry 68802

68.48 SOLID-SOLID INTERFACES

(inc. bicrystals; for grain boundaries, see 61.70N)

67375 Formation of $MoSi_2$ by pulsed electron beam irradiation onto a vapor deposited molybdenum/silicon structure. S.Suzuki (Advanced Materials Lab. Inc., Saitama, Japan), Y.Ohkubo, F.Matsuoka, T.Itoh.
Appl. Phys. Lett. (USA), vol.42, no.9, p.797-9 (1 May 1983).
A molybdenum disilicide layer was formed by pulsed electron beam irradiation into a vapor deposited Mo film on a Si substrate. The electron beam with a duration of almost 1 μs was generated by glow discharge of He at a pressure of 1×10^{-5} Torr in a vacuum chamber equipped with a capacitor of 1μF that was charged at 7 kV. The total energy stored in the capacitor was 25 J and the irradiated area was almost 1 in. in diameter. The qualitative and structural characterizations were performed by Auger electron spectroscopy

(AES), transmission electron diffraction (TED), and transmission electron microscopy (TEM). A depth profile by AES showed that a uniform $MoSi_2$ layer was formed toward the Mo surface from the Mo/Si interface and that C and O contaminants were swept away from the silicide. The hexagonal $MoSi_2$ phase was uniquely identified in the irradiated layer and the TEM micrographs showed uniform polycrystalline grains of a size of 800 Å. (7 refs.)

67376 Microstructural features of Zircaloy-2 and stainless steel AISI-304 L electron beam joint. P.Gr.Lucuta, D.Topa, E.Vasile (Intreprinderea de Cercetare si Productie de Piese Forjate si Turnate Pentru Aviatie, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.9, p.799-804 (1982). In Rumanian.
Diffusion bonding between stainless steel AISI-304 L and Zircaloy-2, as a result of the electron beam impact with the steel (100 μm near the original interface) shows two distinct zones formed by the mutual diffusion of constituent elements. SEM and microanalysis were used to obtain information about the structure and composition of the two diffusion zones, each separately formed in the stainless steel and Zircaloy matrices. The distribution and concentration of constituent elements in the diffusion zones can be explained in connection with the operating diffusion mechanism. (6 refs.)

67377 Investigation of the Cu/GaAs(110) interface formation. D.Bolmont, V.Mercier, P.Chen, H.Luth, C.A.Sebenne (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.509-17 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Low energy electron diffraction (LEED), Auger electron spectroscopy (AES), electron energy loss spectroscopy (ELS) and photoemission yield spectroscopy (PYS) measurements are performed on a set of UHV cleaved n- and p-GaAs(110) crystal surfaces as a function of Cu coverage θ obtained by in-situ evaporation in the range $10^{-3} \lesssim \theta \lesssim 200$ monolayers (ML). A model of interface formation is developed where, first, a uniform nonmetallic double layer, including a two-dimensional compound associating Cu, As and Ga atoms, forms to be completed below 2 ML; then, growth of metallic Cu islands occurs. It explains the full set of experimental results, including the observed electron state density changes at the interface and the characteristics of the Schottky barrier formation. (13 refs.)

Segregation of solute atoms at dislocations in low-angle grain boundaries .... See Entry 67009

Ion-induced amorphous and crystalline phase formation in Al/Ni, Al/Pd, and Al/Pt thin films .... See Entry 67054

Lateral growth of titanium silicide over a silicon dioxide layer .... See Entry 67294

Morphogenetic aspects of the LPE heterostructure growth: time evolution of configuration entropy .... See Entry 67379

Properties of Pd/Au thin film layered structures .... See Entry 67757

Photoemission studies of reactive diffusion and localized doping at II-VI compound semiconductor-metal interfaces .... See Entry 68404

Photoemission from MBE grown III-V surfaces and interfaces .... See Entry 68406

68.55 THIN FILM GROWTH, STRUCTURE, AND EPITAXY

(for techniques of crystal growth and film deposition, see 81.10 and 81.15)

67378 Non-destructive determination of composition and thickness of multi-component alloy thin films by X-ray fluorescence spectroscopic method. Cheng Jian-Bang, Cheng Wan-Rong, Wang Xi-Hong (Inst. of Phys., Acad. Sinica, Peking, China), Hao Gog-Zhang, Wu Zhang-Cun.
Acta Phys. Sin. (China), vol.32, no.2, p.251-5 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
A non-destructive method for determination of composition and thickness of ternary alloy thin film by using the technique of X-ray fluorescence spectroscopy, is employed in this paper. In this method, it is not necessary to prepare any similar solid or pure elemental standards, instead, the filter disk standards are used. These disk standards can be made readily and are stable for long period of time. A set of equations relating the characteristic X-ray intensities from elements in the film and its surface densities are formulated and solved for for film composition. The quantitative dependence of attenuation of characteristic X-ray intensities of elements in substrate on increasing film thickness is used to determine the thickness. This method can be used to measure the film composition and thickness simultaneously. (10 refs.)

67379 Morphogenetic aspects of the LPE heterostructure growth: time evolution of configuration entropy. F.Srobar (Inst. of Radio Engng. & Electronics, Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.321-8 (1983).
The concept of the configuration entropy ΔS_{conf}, introduced originally in the context of heterojunction superlattices, is extended to cover general one-dimensional concentration profiles. Changes in ΔS_{conf} as well as in its production rate $P_{conf}=d\ \Delta S_{conf}/dt$ accompanying the growth of single and double $Al_xGa_{1-x}As$ based heterostructures are evaluated for a suitable set of relevant parameters. $-\Delta S_{conf}$ is shown to increase monotonously during the growth process, while the $-P_{conf}$ vs. t dependences may exhibit sharp maxima and discontinuities in response to movements of the LPE apparatus slide. Given the fact that ΔS_{conf} measures departure of the atomic population from the homogeneous (macroscopically structureless) equilibrium condition, such studies in effect monitor time distribution of the morphogenetic activity by the LPE growth processes. (11 refs.)

67380 Stabilization of the melt composition in Ga-Al-Sb-As. A.N.Baranov, S.G.Konnikov, T.B.Popova, V.E.Umansky, Yu.P.Yakovlev (A.F. Ioffe Phys. Tech. Inst., Acad. of Sci., Leningrad, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.349-53 (1983).
The authors present a new effect of stabilization of the Ga-Al-Sb-As melt composition when it is in contact with a GaAs substrate. It was found that the As content in the Ga-Al-Sb-As melt did not depend on the initial Sb concentration when the liquid phase was formed by saturating the Ga-Al-Sb melt from the GaAs substrate. This effect is supposed to be due to the change in phase equilibria conditions caused by large lattice mismatch between the substrate and the solid in equilibrium with the liquid. (10 refs.)

67381 Doping mechanism and properties of Zn-doped GaN-epitaxial layers. V.M.Andreev, M.N.Petrov, I.G.Pichugin (V.I. Uljanov Leningrad Electrical Engng. Inst., Leningrad, USSR).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.435-44 (1983).
The role of oxygen in the process of doping GaN with Zn is established. It is shown theoretically and experimentally that Zn is dissolved in GaN in the form of Zn-O complexes when oxygen or water vapour is present in the ambient of the growth reactor. Most of the complexes are neutral. Only the small part of Zn introduced is situated in electrically active positions. This fact can explain the enormously high Zn concentration which is necessary to obtain the compensation of GaN native donors. The electrical and luminescence properties of GaN epitaxial layers doped by Zn are studied and the relation of these properties to the growth and doping conditions is considered. (17 refs.)

67382 Iso-epitaxial growth of n-octacosane crystals. P.B.V.Prasad, I.V.K.Bhagavan Raju.
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.445-50 (1983).
Iso-epitaxial (epilayer) growth of n-octacosane crystals is reported. The morphology of the epilayers is in the form of triangular growth islands with or without truncature. Epilayer growth precedes spiral growth mechanism which occurs at medium and low supersaturations, respectively. The occurrence of triangular and truncated rhombic platelets is found to be a manifestation of growth at medium supersaturations. (21 refs.)

67383 Dynamics of film growth of GaAs by MBE from RHEED observations. J.H.Neave, B.A.Joyce (Philips Res. Labs., Redhill, England), P.J.Dobson, N.Norton.
Appl. Phys. A (Germany), vol.A31, no.1, p.1-8 (May 1983).
Detailed observations have been made of the intensity oscillations in the specularly reflected and various diffracted beams in the RHEED pattern during MBE growth of GaAs, $Ga_xAl_{1-x}As$ and Ge. The results indicate that growth occurs predominantly in a two-dimensional layer-by-layer mode, but there is some roughening, which is enhanced by deviations from stoichiometry and the presence of impurities. In the case of the GaAs (001) -2×4 reconstructed surface a combination of dynamic and static RHEED measurements has provided firm evidence for the presence of one-dimensional disorder features as well as surface steps. (22 refs.)

67384 Effect of lattice mismatch on the solidus compositions of $Ga_xIn_{1-x}P$ liquid phase epitaxial crystals. J.Ohta, M.Ishikawa, R.Ito, N.Ogasawara (Dept. of Appl. Phys., Faculty of Engng., Univ. of Tokyo, Tokyo, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L136-8 (March 1983).
Liquid phase epitaxy of $Ga_xIn_{1-x}P$ on (100)-oriented GaAs and $GaAs_{0.8}P_{0.2}$ substrates has been studied. Results indicate that the solidus compositions of $Ga_xIn_{1-x}P$ on both substrates tend to be 'locked' near the lattice matching composition. This 'composition pulling' effect is shown to be consistent with a model that takes account of the contribution of lattice mismatch strain energy.

67385 The influence of an external electric field on the silicon homoepitaxy process. Yu.D.Cistjakov, Yu.P.Raynova (Moskovskijh Inst. Elektronnoj Tech., Moscow, USSR), H.G.Schneider.
Electron Technol. (Poland), vol.13, no.1-2, p.117-31 (1980).
The authors present results of an investigation of the electrocatalytic effect on the surface of silicon substrate crystals during nucleation of homoepitaxial silicon layers. An attempt is made to analyse the effect of an external electric field on the formation of an epitaxial interlayer between the substrate and epitaxial layer as well as on the redistribution of impurities in this boundary layer and in the solid-gas interface during the silicon tetrachloride-hydrogen CVD process. The results obtained are used to evaluate the probability of the existence of elementary stages, which are typical of the heterogeneous interaction mechanism between $SiCl_4$ and H_2. (17 refs.)

67386 The top silicon layer of SOI formed by oxygen ion implantation. R.F.Pinizzotto, B.L.Vandrager, S.Matteson, H.W.Lam, S.D.S.Malhi (Central Res. Labs., Texas Instruments Inc., Dallas, TX, USA), A.H.Hamdi, F.D.McDaniel.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1718-21 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
High dose oxygen ion implantation has been used to form a buried oxide layer in Czochralski grown silicon. Wafers were implanted with 300 keV $O_2{}^+$ to a total dose of 1.32×10^{18} ions cm^{-2}. A 0.5 m thick SiO_2 layer is formed beneath a 0.17 μm thick top Si layer. Epitaxial films were grown on both annealed and unannealed wafers. Samples were subsequently annealed at 1150°C for times from 10 to 240 minutes in either Ar or N_2. The highest quality epitaxial layers were obtained with substrates that were annealed after implantation, but prior to epitaxial growth for 2 hrs at 1150°C followed by 4 hrs at 1150°C after epitaxial growth. RBS channeling shows that the top 300 nm of these films have ⟨110⟩ channel backscattering yields lower than any SOI produced to date. The buried oxide plus epitaxial process is a leading candidate for VLSI applications. (11 refs.)

67387 VLSI materials: a comparison between buried oxide SOI and SOS. A.H.Hamdi, F.D.McDaniel (Dept. of Phys., North Texas State Univ., Denton, TX, USA), R.F.Pinizzotto, S.Matteson, H.W.Lam, S.D.S.Malhi.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1722-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
High dose oxygen ion implantation in Si has been used to form a 0.48 μm thick buried oxide layer. The total dose was 2.1×10^{18} O^+/cm^2 implanted at 150 keV/atom. Epitaxial growth was employed to deposit a 0.38 μm thick layer on top of the implanted wafers. High quality single crystal Si on the entire 76 mm diameter wafer was achieved. The microstructure of the buried oxide SOI is compared to SOS material. (18 refs.)

67388 Condensed layers of molybdenum and tungsten silicides. V.B.Blokha, N.T.Gladkikh, P.I.Glushko, V.I.Zmii, G.N.Kartmazov, N.S.Poltavtsev (Kharkov Physicotech. Inst., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.5, p.677-80 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.805-8 (May 1982). [received: Feb. 1983]
By condensation under high vacuum, a set of phases has been obtained, corresponding strictly to the phase diagrams of the molybdenum-silicon and tungsten-silicon systems. The condensed silicide films have broader regions of homogeneity in comparison with those observed for different layers, and their formation begins at a substantially lower temperature (770K). In thin condensed layers (below 100 Å) in the tungsten-silicon system, a new FCC phase has been detected. The use of a poorer vacuum, 1.33×10^{-5} Pa, leads to the formation of the Novotnyi phase $Mo_{5-x}Si_{3-y}C_{x+y}$. New data have been obtained on the interplanar distances of the Mo_3Si and Mo_5Si_3 phases. (10 refs.)

67389 Epitaxial growth of tungsten and tungsten-rhenium alloys from the gas phase. Yu.V.Lakhotkin, A.I.Krasovskii (Inst. of Phys. Chem., Acad. of Sci., USSR).

Inorg. Mater. (USA), vol.18, no.5, p.686-9 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.816-19 (May 1982). [received: Feb. 1983]

The growth forms of the nucleation centers of tungsten and a solid solution of rhenium in tungsten on the (100), (111), and (110) tungsten planes correspond in the equilibrium growth figure of BCC metals, namely a rhombodecahedron. The growth form of the nucleation centers in the deposition of the W+6 mass % Re alloy has more pronounced faceting and is more stable with growth in size of the nucleation center than in the case of the deposition of tungsten. Alloying of tungsten with rhenium in the solubility region by this method increases the rate of growth of individual nucleation centers, their density, and the thickness of the layer in which the epitaxial film forms. The growth rate of the epitaxial film depends on the orientation of the base. The greatest growth rate of tungsten and the alloy studied was found on the (100) plane, and the lowest rate was found on the (110) plane. The density of the nucleation centers on tungsten and the alloy studied on the (100) plane was three orders of magnitude greater than that for the nucleation centers on the (110) plane. (8 refs.)

67390 Composition, structure, and properties of pyrolytic iron oxide films. S.S.Olevskii, A.L.Tolstikhina, K.S.Gasonov, A.V.Koshchienko, M.S.Sergeev, B.I.Kozyrkin, B.G.Gribov.

Inorg. Mater. (USA), vol.18, no.5, p.706-10 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.841-6 (May 1982). [received: Feb. 1983]

The pyrolysis temperature and the oxygen concentration in the gas phase are the principal factors that determine the structure of iron oxide films formed on a given support. It was established that the width of the transition region and the effect of relative enrichment of the transition region with iron depend on the pyrolysis temperature and the oxygen concentration in the composition of the gaseous reaction mixture. The structure of the short-range order of amorphous iron oxide films contains the elements of two polymorphous modifications, namely α- and γ-Fe_2O_3, and that it can be interpreted as the geometrical configuration of trigonal bipyramids with D_3 symmetry. (15 refs.)

67391 Nonuniformity in the deformation and substructure of epitaxial layers of $Mg_xMn_{1-x}Fe_2O_4$/MgO. O.G.Alaverdova, L.P.Koval, I.F.Mikhailov, M.Ya.Fuks, L.A.Mitlina, V.V.Molchanov (V.I. Lenin Khar'kov Polytech. Inst., Kharkov, Ukrainian SSR).

Inorg. Mater. (USA), vol.18, no.6, p.858-62 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1020-4 (June 1982). [received: Feb. 1983]

It is shown that the substructure and nonuniformity of the residual deformation of epitaxial layers of $Mg_xMn_{1-x}Fe_2O_4$ create developed relief of the surface of the MgO substrate and compensate for the misfit stresses on vertical phase boundaries. The composition of the solid solution $Mg_xMn_{1-x}Fe_2O_4$ is uniform. (2 refs.)

67392 Study of structural inhomogeneities in epitaxial layers of gallium arsenide. N.A.Klebanova, M.M.Melamed, S.V.Nosikov, I.N.Sorokin, G.N.Terent'eva.

Inorg. Mater. (USA), vol.18, no.7, p.925-7 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1093-5 (July 1982). [received: Feb. 1983]

As a result of a complex investigation of structural defects of epitaxial layers of gallium arsenide, the authors have established that defects of non-dislocational origin may be the determining reason for local changes in the electrophysical properties of the material and the semiconductor structures: growth defects (pits) are centers for local carrier multiplication in an electric field, and their density may reach 5×10^6 cm^{-2}. Impurity deposits serve as sources of enhanced carrier recombination, and their density varies between 10^3-5×10^6 cm^{-2}. The authors examined the characteristics of etching gallium arsenide in an etchant based on chromic anhydride. They established that the etchant affects the distribution of particles of the second phase in the structure of gallium arsenide, in the form of a pattern of characteristic dome-shaped nodules. Furthermore, the etchant provides an overall picture of the inhomogeneities distributed with respect to depth of the expitaxial layer. (7 refs.)

67393 Structure and photoelectric properties of films of solid solutions of the system $Na(K)SbS_2$-Sb_2S_3. V.A.Bazakutsa, V.B.Lazarev, N.I.Gnidash, L.P.Zozylya, A.V.Salov (V.I. Lenin Khar'kov Polytech. Inst., Kharkov, Ukrainian SSR).

Inorg. Mater. (USA), vol.18, no.7, p.928-30 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1096-9 (July 1982). [received: Feb. 1983]

On the basis of analysis of the experimental results, the authors have discovered that, by changing the chemical composition of alloys of the system $Na(K)SbS_2$-Sb_2S_3 and the preparation conditions, one may predetermine the degree of structural disorder in the films obtained and the parameters characterizing their physical properties. (9 refs.)

67394 Short-range order in amorphous thin films of indium selenides. V.P.Zakharov, Yu.G.Poltavtsev, G.P.Sheremet.

Inorg. Mater. (USA), vol.18, no.7, p.931-3 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1100-3 (July 1982). [received: Feb. 1983]

For amorphous films of $In_{1-x}Se_x$ with x=0.333, 0.43, 0.538, and 0.60, mainly tetrahedral coordination of nearest neighbors to the indium atoms is characteristic, while the coordination of the selenium atoms is diverse. The amorphous film with x=0.75 has a substantially microheterogeneous short-range order structure which is characterized by the presence of microinclusions of amorphous selenium and indium atoms octahedrally coordinated by selenium atoms. (12 refs.)

67395 Electron microscope study of defects in epitaxial layers of silicon carbide. A.N.Pilyankevich, V.F.Britun, S.I.Vlaskina, O.T.Sergeev (Inst. of Materials Technol., Acad. of Sci., Ukrainian SSR).

Inorg. Mater. (USA), vol.18, no.7, p.959-62 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1136-9 (July 1982). [received: Feb. 1983]

The study of epitaxial SiC layers revealed a number of structural characteristics. Studies on the real structure of thick SiC films appear promising through the use of the transmission electron microscope together with sample preparation by ion bombardment. (10 refs.)

67396 Pore structure of amorphous silicon. V.O.Abramov, Yu.A.Zarif'yants, A.A.Rodina, D.P.Utkin-Edin (M.V. Lomonosov Moscow State Univ., Moscow, USSR).

Inorg. Mater. (USA), vol.18, no.7, p.1032-3 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1226-7 (July 1982). [received: Feb. 1983]

The porosity of layers of a-Si:H obtained by decomposing monosilane in a high-frequency glow discharge and depositing it on a substrate at 510K have been investigated. Measurements have been made of the adsorption and desorption isotherms of water vapor at 293K by means of a quartz piezoresonance balance. The working frequency of the AT-cut resonator, 0.65 μm thick, with a-Si:H layers deposited on both sides, was 3.388 MHz. The coefficient of roughness of the layers was determined by analyzing the low-temperature adsorption of argon by the method of Brunauer, Emmett, and Teller (1948). (6 refs.)

67397 Structural and compositional characterization of mixed CdS-CdSe films grown by cathodic electrodeposition. A.S.Baranski, W.R.Fawcett, K.Gatner, A.C.McDonald, J.R.MacDonald, M.Selen (Univ. of Guelph, Guelph, Ontario, Canada).

J. Electrochem. Soc. (USA), vol.130, no.3, p.579-83 (March 1983).

Mixed CdS-CdSe films have been electrodeposited cathodically from DMSO solutions containing cadmium chloride, elemental sulfur and elemental selenium. The mixed films were characterized structurally using X-ray diffraction, scanning electron microscopy, and Rutherford backscattering spectrometry. The photoelectrochemical response of the CdS-CdSe material was studied in a photoelectrochemical cell with a sulfide-polysulfide electrolyte. It has been found that the composition and optical bandgap of the CdS-CdSe films can be varied by changing the composition of the deposition solution. However, the films with higher CdSe content are amorphous, and have a higher resistivity than pure CdS. (9 refs.)

67398 Lattice parameter changes in $Al_{0.39}Ga_{0.61}As$ due to O, Ge, Si, and S doping. W.R.Wagner, N.E.Schumaker, J.L.Zilko, P.J.Anthony, V.Swaminathan (Bell Labs., Murray Hill, NJ, USA).

J. Electrochem. Soc. (USA), vol.130, no.3, p.670-5 (March 1983).

The change in lattice parameter of epitaxial films of $Al_{0.39}Ga_{0.61}As$ was investigated as a function of growth solution doping. With the lattice constant of GaAs as the reference constant, it was found that the presence of either O_2 in the growth ambient or Ge in the growth solutions dilated the lattice. Growth solution doping with Si was found to initially dilate the lattice while further Si doping resulted in a lattice contraction. Sulfur doping contracted the lattice. It was found that the lattice dilation due to to O_2 in the growth ambient principally resulted from a reduction in the background S contamination of the epitaxial films. (30 refs.)

67399 Deposition of GaAs epitaxial layers by organometallic CVD. Temperature and orientation dependence. D.H.Reep, S.K.Ghandhi (Dept. of Electrical, Computer & Systems Engng., Rensselaer Polytech. Inst., Troy, NY, USA).

J. Electrochem. Soc. (USA), vol.130, no.3, p.675-80 (March 1983).

Epitaxial layers of GaAs have been grown in an atmospheric organometallic CVD system for a wide variety of gas phase reactant partial pressures and over a broad range of temperature (450°-1050°C). The growth rates for (100), (100)+3°→⟨110⟩, (110), (111)Ga, and (111)As substrates are reported as functions of temperature and gas composition. Three distinct temperature dependent regions of growth are identified, corresponding to a mid-temperature mass transport limited range, a low-temperature kinetic controlled regime, and a high-temperature desorption limited region. The growth rate is studied as a function of the growth parameters and substrate orientation, and is related to the decomposition of the two reactants trimethylgallium and arsine. A model for the epitaxial growth of GaAs by the organometallic process is proposed, based on these findings. (25 refs.)

67400 Effects of ion implantation on the thermal growth of Pt and NiPt silicides. T.W.Orent, C.I.Knudson, J.A.Sartell (Honeywell Corporate Technol. Center, Bloomington, MN, USA), S.Lee, T.L.Brewer.

J. Electrochem. Soc. (USA), vol.130, no.3, p.687-91 (March 1983).

The effects of low-dose ion implantation of inert gas ions, prior to thermal annealing on the interactions between Pt and NiPt thin films with various forms of silicon, have been investigated. Specimens were implanted with Kr^{2+} and then annealed along with unimplanted samples in the temperature range 350°-650°C. The extent of silicide formation and the phases formed were determined by Auger electron spectroscopy (AES), X-ray diffraction, and transmission electron microscopy (TEM). The implanted Pt films reacted to form complete layers of Pt_2Si which then continued to react to form highly textured layers of PtSi. However, in the implanted samples, no distinct Pt_2Si layers were observed, and the final PtSi phases were fine grained and polycrystalline. In the case of NiPt films, ion implantation inhibited the formation of the distinct Pt silicide layers found during the early stages of the reaction in unimplanted samples. The differences between implanted and unimplanted NiPt samples became progressively smaller with increasing annealing temperature. The final phase formed in both types of specimens was the ternary silicide, $Ni_xPt_{1-x}Si$. (32 refs.)

67401 Surface mobility of silver and gold on evaporated silver bromide layers. A.Panov, J.Malinowski (Central Lab. of Photographic Processes, Bulgarian Acad. of Sci., Sofia, Bulgaria).

J. Signalaufzeichnungsmater. (Germany), vol.11, no.1, p.5-9 (1983).

The growth of vacuum deposited metal clusters on AgBr layers studied by electron microscopy. The contribution of surface diffusion to the growth process is determined. The independence of the apparent sticking coefficient on the occupied area and the width of the diffusion capture zone around each cluster are discussed. From the electron micrographs it is established that the Ag and Au atoms show substantially greater mobility on AgBr than on NaCl, being largest for Ag. The connection between the Ag mobility and the photographic process is discussed. (14 refs.)

67402 Transmission electron microscopy study of undoped and doped polyacetylene films. M.Rolland (Groupe de Dynamique des Phases Condensees, Univ. des Sci. et Tech. du Languedoc, Montpellier, France), M.J.M.Abadie.

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.626-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Reports experimental results concerning the morphology of nascent polacetylene films. The growing process of the fibrils is pointed out and especially the existence of microfibrils. The intrafibrillar aspect is discussed. Elsewhere the dopants' location and diffusion inside the fibril are shown in the case of liquid phase ($MoCl_5$) and vapour phase (iodine) doping. (10 refs.)

67403 Amorphous to microcrystalline transitions in Si films. E.Bustarret, B.Ranchoux, H.Hamdi, A.Deneuville (Groupe des Transitions de Phases, CNRS, Grenoble, France), S.Haunt, P.Depelsenaire.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.950-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Thin films of amorphous silicon were deposited below 630°C by pure LPCVD. In situ post hydrogenation is shown to induce an additional relaxation of the Si matrix achieving progressive crystallisation of these films. The effect of the hydrogen on the intermediate range order is checked by measuring the hydrogen content and the X-ray diffraction and Raman linewidth. The similarity between amorphous and microcrystalline silicon that have been observed brings a further support to the multiphase description of a-Si:H. The coplanar photoconductivity of the films post-hydrogenated 30 mn at 400°C is equal to that of the best glow discharge films. (13 refs.)

67404 Metal-induced crystallization of hydrogenated amorphous Si films. C.C.Tsai, R.J.Nemanich, M.J.Thompson, B.L.Stafford (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.953-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Metal films of Au, Al and Pd deposited on hydrogenated amorphous Si cause the formation of crystalline Si at temperatures well below its normal crystallization temperature of >650°C. The structural aspects are explored by SEM, TEM, scanning Auger microprobe (SAM), and interference enhanced Raman scattering (IERS). The structural changes are correlated with changes of the current-voltage characteristics of the resulting Schottky barriers. (6 refs.)

67405 Formation of AlSb by laser and capacity discharge annealing. L.Baufay, R.Andrew, A.Pigeolet, L.D.Laude (Univ. de l'Etat, Mons, Belgium).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1027-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The preparation of AlSb thin films by either pulsed laser or capacity discharge annealing of Al/Sb sandwiches is compared in order to shed light upon the nature of the transformation. Using 1000 Å thick multilayer films supported by glass substrates, the authors investigate the energy threshold for complete transformation as a function of pulse duration from 10^{-7} to 10^{-1} s. They then calculate the temperature effect directly induced by the energy pulse to be at least 900K or approximately the melting points of the metals. (9 refs.)

67406 Effects of MBE growth conditions on carbon contamination in GaAs. O.Tejayadi, Y.L.Sun, J.Klem, R.Fischer, M.V.Klein, H.Morkoc (Coordinated Sci. Lab., Univ. of Illinois, Urbana, IL, USA).
Solid State Commun. (USA), vol.46, no.3, p.251-4 (April 1983).
The effects of growth and pre-growth conditions on the background concentration of carbon in high quality undoped GaAs layers grown by molecular beam epitaxy have been studied. Characterization of the layers by low temperature photoluminescence indicates that a growth temperature of 580°C minimizes carbon contamination, and extended pre-growth outgassing of the substrate under an As_4 over-pressure results in increased carbon concentrations. The carbon incorporation was found to be relatively insensitive to outgassing temperature above 615°C. Contrary to expectations, increasing the As/Ga flux ratio during growth resulted in larger carbon luminescence peaks. (9 refs.)

67407 Transparent conductive films of tin oxide-preparation and properties. J.George, K.S.Joseph (Dept. of Phys., Univ. of Cochin, Cochin, India).
Solid State Commun. (USA), vol.46, no.7, p.541-4 (May 1983).
Transparent conducting films ($T=87\%$, $\rho=2\times10^{-2}$ ohm cm) of tin oxide have been prepared by the oxidation in air of reactively evaporated tin disulphide films. It has been found that the time taken for the onset of oxidation at different temperatures can be represented by a simple rate relationship. The variation of resistivity of the films with oxidation temperature and heating rate is explained on the basis of the rate of crystallization of the as prepared amorphous sulphide films and the rate of oxidation. A direct transiton at 4.0±0.1 eV has been detected in agreement with earlier reported values. The films obtained show *n*-type conductivity. The oxide films are homogeneous and have strong adhesion to the substrate. (24 refs.)

67408 Sn overlayers on cleaved InSb(110) surfaces. M.Mattern, H.Luth (II. Phys. Inst., RWTH, Aachen, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.502-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Auger electron spectroscopy (AES), electron energy loss spectroscopy (ELS) and low energy electron diffraction (LEED) have been used to characterize Sn overlayers on InSb(110) surfaces prepared by cleavage in UHV. At the interface the Sn forms homogeneous layers rather than islands and diffusion of Sb into the overlayer is observed. The LEED results indicate only short range order of the Sn atoms. According to ELS, the bonding configuration appears to be tetrahedral like in α-Sn for a coverage below 50 monolayers, whereas thick layers of several hundred monolayers show β-Sn character. (13 refs.)

67409 Structure of electrolytic cobalt-nickel alloy deposits. I.G.Zhikhareva, A.I.Zhikharev (Tyumen Industrial Inst., Tyumen, USSR).
Sov. Electrochem. (USA), vol.18, no.7, p.876-8 (July 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.7, p.983-6 (July 1982). [received: March 1983]
The alloying of electrodeposited metals is an efficient method to produce coatings with improved physical and mechanical properties; these properties, in the final analysis, are determined by the number of crystal imperfections (twins, stacking faults, microstresses, mosaic block sizes, dislocation density, etc.) present in the deposits to be examined. The authors studied the probability of stacking fault (SF) formation and the dislocation density of two-phase electrolytic Co-Ni alloys on cobalt base. (5 refs.)

67410 Anisotropic properties and structure of amorphous films of selenium. V.Krisciunas, B.Petretis, R.Rinkunas (Dept. of Phys., Vilnius V. Kapsukas State Univ., Vilnius, USSR).
Thin Solid Films (Switzerland), vol.102, no.2, p.111-16 (15 April 1983).
It is shown experimentally that anisotropic columnar inhomogeneous structures form in evaporated amorphous selenium films. The angle of orientation of the structures corresponds to the angle of incidence of the molecular flow. The diameter and density of inhomogeneities in the amorphous films, evaporated at an acute angle, changed by a factor of 30 with a change in the substrate temperature from 20 to 60°C, as a result of diffusion mass transfer of condensed material on the substrate. (9 refs.)

67411 Structure of indium tin oxide electrodes on zirconia. M.Privman, J.Berger, D.S.Tannhauser (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Thin Solid Films (Switzerland), vol.102, no.2, p.117-22 (15 April 1983).
A necessary condition for the preparation of smooth indium tin oxide (ITO) layers prepared by chemical vapour deposition is that the substrate is smooth. For the thinnest films of ITO on zirconia the layer is smooth, but pores were observed along the boundaries of the substrate grains. For layers thicker than 0.25 μm, small and large grains appear, and the sizes of both grow linearly with the layer thickness. On annealing the films in air the number of large grains increases. The difference between the large grains and the background is not chemical. The layers grown are polycrystalline, but there is a preferred direction. (6 refs.)

67412 Substrate-induced lattice strain in particulate palladium deposits. L.B.Garmon, D.L.Doering (Ames Res. Center, NASA, Moffett Field, CA, USA).
Thin Solid Films (Switzerland), vol.102, no.2, p.141-8 (15 April 1983).
Particulate films of palladium were vapor deposited onto single-crystal surfaces of MgO and ultrahigh-vacuum-cleaved mica. For small particles (average diameters less than 10 nm), an increase in the palladium lattice parameter was observed by selected area transmission electron diffraction. Palladium films on MgO grew epitaxially with a lattice expansion that was nearly uniform with particle size although a possible sawtooth variation in the strain with particle size is also discussed. The amount of change in the palladium lattice parameter for films grown on ultrahigh-vacuum-cleaved mica increased with diminishing particle size. The substrate temperature during deposition affected the epitaxy and structure of the particles and thus also changed the degree of lattice distortion. (16 refs.)

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Composition of the gas phase in the Cd-Te-N-H-I system ...... See Entry 66663

The structure and the medium range order in thin amorphous germanium films prepared in UHV .... See Entry 66837

Structural order and optical properties of tetrahedral amorphous solids .... See Entry 66845

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Growth of hydrogenated amorphous silicon due to controlled ion bombardment from a pure silane plasma .... See Entry 68461

Liquid phase epitaxy of $Ga_xIn_{1-x}As_yP_{1-y}$ .... See Entry 68463

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68.60 PHYSICAL PROPERTIES OF THIN FILMS, NONELECTRONIC

67413 Diffusion of arsenic and phosphorus in laser-processed-polycrystalline-silicon-thin-films. H.Baumgart, H.J.Leamy, L.E.Trimble, C.J.Doherty, G.K.Celler (Bell Labs., Murray Hill, NJ, USA).
Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.311-16
Grain boundary diffusion of arsenic and phosphorus in laser processed polycrystalline Si films has been investigated. Mesa diodes were fabricated in LPCVD Si thin films on SiO_2 and subsequently recrystallized by cw Ar ion laser processing to form large grain material. The diffusion length of enhanced As and P diffusion along grain boundaries intersecting the p-n junction has been measured by the EBIC technique. Quantitative experimentation allowed determination of the grain boundary diffusion coefficients of As and P in the temperature range from 900°C to 1250°C. (12 refs.)

The structure and the medium range order in thin amorphous germanium films prepared in UHV .... See Entry 66837

Resolution of dislocation lines in germanium by etching .... See Entry 67000

Effect of phosphorus doping on stress in silicon and polycrystalline silicon .... See Entry 67025

Condensation diagram for thin films of CdS_xTe_{1-x} solid solutions .... See Entry 67175

Composition, structure, and properties of pyrolytic iron oxide films .... See Entry 67390

Nonuniformity in the deformation and substructure of epitaxial layers of $Mg_xMn_{1-x}Fe_2O_4$/MgO .... See Entry 67391

70.00 CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES

(see also 81.40R Electrical and magnetic properties related to materials treatment, 81.40T Optical properties related to materials treatment)

Physics of Non Crystalline Solids. Proceedings of the 5th International Conference .... See Entry 64580

71.00 ELECTRON STATES

(see also 63. Lattice dynamics, 73. Surfaces, interfaces, and thin films)

71.10 GENERAL THEORIES AND COMPUTATIONAL TECHNIQUES

67414 Ergodicity and density of states in a 1D crystal. J.V.Jose (Phys. Dept., Northeastern Univ., Boston, MA, USA).
J. Phys. A (GB), vol.16, no.7, p.L205-8 (11 May 1983).
Using a decimation technique, the band structure in a 1D periodic solid is shown to be related to the ergodic Ulam-Von Neumann map, $C_{r+1}=1-2C_r^2$. (11 refs.)

67415 On inverting the metric matrices of crystals using the Fourier series method. O.Aikala (Dept. of Phys. Sci., Univ. of Turku, Turku, Finland).
J. Phys. C (GB), vol.16, no.12, p.2217-23 (30 April 1983).
The Fourier series method for calculating the inverse of the metric matrix of crystals (needed in the orthogonalisation of one-electron orbitals) is presented for the general case. In this method the matrix is first partially diagonalised by a unitary transformation (the Fourier series). After inverting the small diagonal blocks, the inverse transformation (summation/integration in the Brillouin zone) is performed to obtain the elements of the inverse metric matrix. Crystals with full orthorhombic, hexagonal or cubic site symmetries are considered in detail. Numerical applications to NaF, LiF and MgO crystals with NaCl structure have been performed and the results are compared with those obtained by the cluster method. For ionic crystals the present procedure is better than the cluster one as regards the accuracy and stability of the results even though the computing times become larger in some cases. The computing procedure in this form is found to be unsuitable for metals and several improvements are found necessary. (22 refs.)

67416 Exact solution of the Anderson model: I. P.B.Wiegmann, A.M.Tsvelick (Landau Inst. for Theoretical Phys., Moscow, USSR).
J. Phys. C (GB), vol.16, no.12, p.2281-319 (30 April 1983).
The complete solution of the non-degenerate Anderson model describing the formation of the localised moment in a metal is constructed on the basis of the Bethe ansatz method. Explicit expressions for the magnetic susceptibility and specific heat are derived at zero temperature but with arbitrary parameters U, Γ and ϵ_d. In the symmetric case the dependence of the impurity magnetisation on the magnetic field is obtained at zero temperature. The asymmetric Anderson model is studied in detail. Explicit expressions for the dependence of the susceptibility and occupation number on the effective resonance level position are derived. (48 refs.)

67417 Exact solution of the Anderson model. II. Thermodynamic properties at finite temperatures. A.M.Tsvelick, P.B.Wiegmann (Landau Inst. for Theoretical Phys., Moscow, USSR).
J. Phys. C (GB), vol.16, no.12, p.2321-36 (30 April 1983).
For pt.I see ibid., vol.16, p.2281 (1983). On the basis of the exact solution which was considered in the previous paper the thermodynamic properties of the Anderson model are studied. (14 refs.)

Large coupling behaviour of the Lyapunov exponent for tight binding one-dimensional random systems .... See Entry 64827

71.20 ELECTRONIC DENSITY OF STATES DETERMINATIONS

(inc. energy states of liquid semiconductors; see also 65.40 Lattice and electronic heat capacity)

67418 Generalization of the Green's-functions formalism to nonorthogonal orbitals: application to amorphous SiO_2. D.Lohez, M.Lannoo (Lab. de Phys. des Solides, Inst. Superieur d'Electronique du Nord, Lille, France).
Phys. Rev. B (USA), vol.27, no.8, p.5007-11 (15 April 1983).
It is shown that the Green's-function formalism can be extended to nonorthogonal wave functions. This new technique is illustrated on the example of amorphous SiO_2 where the calculated partial densities of states are compared to experimental data. (22 refs.)

67419 Multiple scattering theory of the density of states in semiconductors. A.H.Kahn, J.R.Lowney (US NBS, Washington, DC, USA).
Solid State Commun. (USA), vol.46, no.3, p.229-33 (April 1983).
A method for calculating the electronic density of states of a semiconductor in the presence of impurity scattering is given. The approach is based on a low density multiple scattering expansion. The calculation treats the density of states of the conduction band, shifts of the band edge, and the profiles of the impurity bands. It is performed for a simple model, using a spherical well potential for the individual impurity centers, but could be extended to any scattering potential. The first impurity band forms when the potential is sufficiently strong that one center can bind an electron. The impurity bands are of finite width, have a flat upper edge, and an asymmetrically broadened tail on the low energy side. (18 refs.)

Ergodicity and density of states in a 1D crystal .... See Entry 67414

A theoretical study of the *x*-dependence of the conduction-band density of states in metallic sodium tungsten bronzes Na_xWO_3 .... See Entry 67448

Spin polarization of Ni overlayers on an Al(100) substrate .... See Entry 67974

Magnetism of Fe thin films in contact with Al(100) substrate .... See Entry 67975

71.25 NONLOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

67420 Electronic structures of higher stage graphite intercalation compounds. T.Ohno, H.Kamimura (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.611-13 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Self-consistent non-empirical calculations of the band structures of higher stage graphite intercalation compounds up to the 6th stage were performed using the local density functional formalism. The charge distribution along the c-axis is extremely inhomogeneous, and the orbital contribution to the magnetic susceptibility, which is paramagnetic, reaches a maximum at about stage 6 in the case of $f=1.0$. Finally, the stage dependence of the total energy was determined. (11 refs.)

67421 Band structure properties of one-dimensional donor-acceptor model polymers. M.C.Bohm (Inst. fur Organische Chem., Univ. Heidelberg, Heidelberg, Germany), H.Vogler.
Solid State Commun. (USA), vol.46, no.2, p.201-4 (April 1983).
The band structure of one-dimensional donor-acceptor (DA) stacks have been studied by means of the crystal orbital formalism based on a semi-empirical INDO approximation. The model polymers are composed of quinhydrone moieties (**1** and **2**) with different mutual orientations of D and A. The DA capability was modified by varying the DA distance within the unit cell as well as the effective electronegativity of the active groups of D and A. An insulator-to-metal transition is predicted for **1** at short DA distance and larger differences in the electronegativities of D and A. An avoided crossing between the highest filled and the lowest unfilled $\epsilon(k)$ curves is encountered in **2** leading to a finite band gap for all studied DA interaction conditions. (10 refs.)

Auger lineshape analysis .... See Entry 68369

The electronic structure of polyphenyls and poly(p-phenylene) .... See Entry 68399

71.25C Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc)

67422 Cohesive energy in strongly correlated electronic systems in the non-degenerate band approximation. M.Acquarone (Istituto di Fisica, Univ. di Parma, Parma, Italy), D.K.Ray, J.Spalek.
J. Phys. C (GB), vol.16, no.12, p.2225-36 (30 April 1983).
The electronic contribution to the cohesive energy is calculated in narrow band systems where the splitting of bands due to intra-atomic correlation is larger than the band width by solving the effective Hamiltonian for the lower Hubbard subband in the non-degenerate band approximation on the basis of different decouplings of the quasielectron Green function. Using a rectangular form of the density of states for non-interacting electrons analytical expressions for the ground state energies for different magnetic phases are obtained. The importance of the kinetic exchange on the stability of the magnetic phases is indicated for different fillings of the band. The significance of these results for the understanding of the cohesive energies of strongly correlated systems is discussed. (16 refs.)

67423 Universal tight-binding parameters for cubic IV-VI compounds. P.Enders (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K15-18 (1 March 1983).
The universal parameterization of the resonance integrals in the form $H_{ll'm}=\eta_{ll'm}/d^2$, where $\eta_{ll'm}$ and d are universal constants and the nearest-neighbour (NN) distance, respectively, is very useful for a qualitative or semi-quantitative description of many solid-state properties. The authors derive the universal parameter form for p-p-σ resonance integral $H_{pp\sigma}$ for cubic $A^{IV}B^{VI}$ compounds, i.e. GeTe, SnTe, PbTe, PbSe, and PbS, from a consideration of the electronic polarization in these crystals. (11 refs.)

67424 Dependence of tight-binding interactions on coordination and bond length. J.Robertson (Dept. of Phys., Univ. of Illinois, Urbana, IL, USA).
Philos. Mag. B (GB), vol.47, no.4, p.L33-7 (April 1983).
Exceptions to some of the simple rules of tight-binding interaction behaviour are enumerated. A strong polarization dependence of π interactions in graphite is found. The d^{-2} scaling hypothesis is found to fail when s and p orbitals are unequally involved, as in group-V elements or in changes under pressure. (13 refs.)

67425 Algorithms for evaluation of cross sections of isoenergetic surfaces in a pseudopotential approach. Yu.A.Pospelov, S.G.Novikov (S. Ordzhonikidze Moscow Inst. of Control, Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.726-9 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.53-60 (Aug. 1982). [received: April 1983]
Original methods are proposed for a direct approach to the calculation (with extended precision) of flat cross sections of isoenergetic surfaces $E_n(k)=E_0$ for the electrons of a solid, belonging to the n-th energy band. Two different methods to determine points of the contour L(E) of a cross section are considered. They are based on an iterative technique; the points of the contour of a section obtained during the computation are used to determine new points. (4 refs.)

67426 Computation of differential characteristics of cross sections of isoenergetic surfaces and determination of extremal cross sections in a pseudopotential approach. Yu.A.Pospelov, V.I.Mel'nikov, S.G.Novikov (S. Ordzhonikidze Moscow Inst. of Control, Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.729-32 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.56-60 (Aug. 1982). [received: April 1983]
Without using numerical differentiation methods, expressions for computation of differential characteristics of first and second order of flat cross sections of isoenergetic surfaces $S(E,\mathbf{k})$ are obtained (where E is the energy, and **k** is the wave vector). (4 refs.)

Large coupling behaviour of the Lyapunov exponent for tight binding one-dimensional random systems ....See Entry 64827

Ergodicity and density of states in a 1D crystal ....See Entry 67414

On inverting the metric matrices of crystals using the Fourier series method ....See Entry 67415

Generalization of the Green's-functions formalism to nonorthogonal orbitals: application to amorphous SiO_2 ....See Entry 67418

Multiple scattering theory of the density of states in semiconductors ....See Entry 67419

Scattering-theoretical method for relaxed and reconstructed surfaces with applications to GaAs(110) and Si(100)-(2×1) ....See Entry 67735

71.25H Measurement of Fermi surface parameters
(inc. dHvA, magnetoacoustic, position annihilation, and cyclotron resonance studies, etc.)

67427 Anisotropy of electron impurity scattering in dilute Al(Li). W.Joss, W.van der Mark, R.Monnier (Lab. fur Festkorperphys., Eidgenossische Tech. Hochschule, Zurich, Switzerland), L.Cole, W.E.Lawrence.
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.736-54 (1982).
The variation of the conduction electron scattering rate over the third-zone electron sheet of the Fermi surface of aluminum, due to small concentrations of lithium impurities, has been determined from de Haas-van Alphen effect studies. Theoretical results for the Dingle temperatures for orbits on the second-zone hole and third-zone electron sheet of the Fermi surface are reported. Several improvements to the previous theoretical treatment are discussed; these include nonlocal exchanger and correlation in the impurity-induced potential, the effects of lattice relaxation around the impurity, and lattice backscattering. For the last point, the authors exploit the connection between the pseudoplane-wave and KKR-Green's function formalisms. Despite these various improvements, the agreement between experiment and theory is not improved substantially. Possible physical reasons for this are discussed. (30 refs.)

67428 Electron-hole recombination effect on the quantum oscillations of sound velocity for $q \wedge H \sim 90°$ in dilute $Bi_{1-x}Sb_x$ alloys. M.Akinaga (Dept. of Phys., Fukuoka Univ. of Education, Fukuoka, Japan), T.Inoue, S.Mase.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1324-32 (April 1983).
The quantum oscillations of sound velocity in dilute $Bi_{1-x}Sb_x$ alloys with $x=0$, 1.0×10^{-4} and 3.6×10^{-4} have been investigated under the condition that the magnetic field vector H has been applied perpendicularly or nearly perpendicularly to the sound wave vector q. The oscillation-amplitudes in the alloys have been found to be greatly enhanced compared with those in pure bismuth. These are analyzed on the basis of a theory which takes account of the contributions from the limiting point carriers, from the carriers on the nonextremal orbits and the electron-hole recombination process due to the carriers on the extremal orbits. It is shown that the remarkable enhancement in amplitudes is mainly caused by a coupling of two affairs, i.e. one order shorter electron-hole recombination time in the alloys than that in pure bismuth and the contribution from the limiting point carriers as in the case of the attenuation coefficient.

67429 Shubnikov-de Haas oscillations in transition-metal pentatelluride. M.Izumi, S.Harada (Inst. of Phys., Univ. of Tsukuba, Ibaraki, Japan), R.Yoshizaki, K.Uchinokura, E.Matsuura.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.605-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Shubnikov-de Haas oscillations have been studied in group IVB-transition-metal pentachalcogenides, $ZrTe_5$ and $HfTe_5$. In $ZrTe_5$ a single cross section of the Fermi surface with a frequency of 0.049 MG (B//b-axis) dominates the oscillatory behaviour. In $HfTe_5$ the authors obtained the frequency of 0.015 MG from DC magnetoresistance measurements. The AC magnetoresistance suggests that another cross sectional frequency is superposed on the original frequency of 0.015 MG. Observed frequencies of 0.049 MG and 0.015 MG correspond to 0.06% and 0.02% of areas of each Brillouin zone perpendicular to the b-axis. Although the origin of such low frequency oscillations has not been made clear, observed low frequencies in both compounds may be strongly related to the existence of CDWs or other anomalous properties of these compounds. (11 refs.)

67430 Electronic structure of palladium. A.K.Bordoloi, S.Auluck (Phys. Dept., Univ. of Roorkee, Roorkee, India).
Phys. Rev. B (USA), vol.27, no.8, p.5116-18 (15 April 1983).
An attempt is made to obtain a good fit to the Fermi-surface data of Pd by using the interpolation scheme. The starting point was the parameters of the scheme that had been fitted to the photoemission data. Making minimal changes in the parameters, the authors obtain a good fit to the Fermi surface, and at the same time good agreement with the optical data is achieved. (18 refs.)

Possibility of a spectral determination of the gap in the energy spectrum of alkali metals ....See Entry 67435

Low-field galvanomagnetic tensor components for electrons in bismuth ....See Entry 67650

On the conduction band anisotropy in semimagnetic semiconducting $(Cd_{1-x}Mn_x)_3As_2$ alloys ....See Entry 67652

Oscillation of the transparency of metals in a weak magnetic field ....See Entry 67671

The theory of the tilt-effect in metals with a complicated Fermi surface ....See Entry 67702

Semiconductor-metal transition in $Bi_{0.8}Sb_{0.2}$ alloys under tension ....See Entry 67703

Vector potential induced diamagnetism and flux quantization in normal metals ....See Entry 67884

71.25J Effective mass and g-factors

67431 Investigation of bandmasses and G-values by two-photon-magneto-absorption (TPMA) in ZnSe. H.W.Holscher, A.Nothe (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany), Ch.Uihlein.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.395-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors present the first TPMA-measurements (up to 9T) on the 24 fold degenerate 2p-exciton in ZnSe. The measurements were carried out in Faraday- ($\vec{k}\parallel\vec{B}$) and Voigt-configuration ($\vec{k}\perp\vec{B}$). By various combinations of polarization states of the two fundamental beams (σ_+, σ_-; σ, π) one can selectively excite excitons with total angular momentum $M_{tot}=0$, ±1 and ±2. From the large splitting due to the envelope g-value and from the strong diamagnetic shift one can deduce a reliable set of conduction (m_e^*, g_c) and valence band parameters (γ_1, γ_2, γ_3, κ). The detailed calculation of these parameters is based on the theory of Lipari et al. (1973) using irreducible tensor operators. (11 refs.)

Influence of exchange interaction on band structure of $Pb_{1-x}Mn_xTe$ ....See Entry 67445

Cyclotron resonance studies of polarons and screening effects in GaAs ....See Entry 67486

The effective polaron mass in a gapless semiconductor HgTe .See Entry 67487

Dependence of a hydrogen-like impurity spectrum on the magnetic field orientation in the crystal ....See Entry 67537

Polaron nature of charge carriers in silver azide ....See Entry 67635

On the conduction band anisotropy in semimagnetic semiconducting $(Cd_{1-x}Mn_x)_3As_2$ alloys ....See Entry 67652

Measurements of *g*-factor and exchange integral *J* in $Hg_{1-x}Mn_xTe$ by means of tunneling ....See Entry 67866

71.25L Electron energy states in liquid metals

Optical characteristics of Ni-Cr alloys in the solid and liquid states ....See Entry 68148

71.25M Electron energy states in amorphous and glassy solids

67432 Electronic properties of sulfur containing conjugated polymers. J.L.Bredas (Lab. de Chimie Theorique Appl. Facultes Univ. Notre-Dame de la Paix, Namur, Belgium), R.L.Elsenbaumer, R.R.Chance, R.Silbey.
J. Chem. Phys. (USA), vol.78, no.9, p.5656-62 (1 May 1983).
Valence effect Hamiltonian (VEH) calculations are performed on a number of sulfur containing organic conjugate polymers of interest to the conducting polymers area. Theoretical results for parameters related to conductivity such as ionization potentials, bandwidths, and bandgaps are presented. Systems considered include various derivatives of poly (*p*-phenylene sulfide), polybenzodthiophene, and polythiophene, as well as potentially interesting compounds such as polythieno [3,2,-*b*] thiophene and polyvinylene sulfide. The electronic structure description afforded by the VEH method for sulfur containing polymers is demonstrated to be of the same quality as that presented previously for hydrocarbon polymers. In particular, for ionization potentials, good agreement with available experimental data on poly (*p*-phenylene sulfide) and polybenzothiophene is obtained, after scaling downward the VEH values by a 1.9 eV polarization correction. The comparison between the theoretical and experimental XPS spectra for polybenzothiophene is excellent with use of the

same energy scaling factor previously employed for polyacetylene, poly(p-phenylene), and poly(p-phenylene sulfide). These results, in conjunction with previous results obtained on hydrocarbon polymers, lend confidence in the predictive capabilities of this purely theoretical technique. Calculations show that polyvinylene sulfide, as yet unsynthesized, should display very promising characteristics as a conducting polymer. (40 refs.)

67433 Valence band structure of hydrogenated amorphous silicon-carbon alloys studied by photoelectron spectroscopy. Y.Katayama, T.Shimada, K.L.I.Kobayashi (Central Res. Lab., Hitachi Ltd., Tokyo, Japan), C.Jiang, H.Daimon, Y.Murata.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.947-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electronic structure of hydrogenated amorphous silicon-carbon alloys a-Si(x)C(1−x):H in the valence band region is studied systematically by in situ photoelectron spectroscopy using synchrotron radiation with photon energies hνs 30-130 eV. The assignment of the characteristic features in photoelectron spectra is made by using the hν- and x-dependences of the observed photoelectron spectra and the variation of the spectra due to heat treatments. In addition to the systematic variation of valence band structure depending on x, it is revealed that only a small amount of carbon atoms in Si-Si network modify some parts of the valence band greatly and also affect the Si-H bonding. (13 refs.)

Bond ordering in noncrystalline solids ....See Entry 66842

The electrical and optical properties of sodium germanate glasses ....See Entry 67271

Generalization of the Green's-functions formalism to nonorthogonal orbitals: application to amorphous SiO_2 ....See Entry 67418

Electronic properties of doped polyacetylene ....See Entry 67540

Local structure and electronic states in hydrogenated amorphous silicon ....See Entry 67542

Magnetoresistivity of amorphous alloys containing rare earths ....See Entry 67565

Photoabsorption in amorphous semiconductors using a wave guided CO_2 laser ....See Entry 68160

The effect of charged additives on the mobility gap and thermal activation energy of $As_2Se_3Cu_x$ ....See Entry 68161

71.25P Band structure of crystalline metals

67434 Charge densities in FCC transition metals. N.A.Johnston, C.A.Sholl (Dept. of Phys., Univ. of New England, Armidale, NSW, Australia).
J. Phys. F (GB), vol.13, no.5, p.945-52 (May 1983).
A simple and accurate means of reproducing the band structure of an FCC transition metal is by means of a model Hamiltonian which depends on a set of parameters determined from known energy eigenvalues at symmetry points in the Brillouin zone. It is shown that the model Hamiltonian can also reproduce the metal charge density with good accuracy if care is taken with the choice of atomic orbitals to be used in the calculations. Calculations are performed for Ni, Cu, Rh, Pd and Ag and the spherically averaged charge densities obtained from the model Hamiltonian are compared with those of Moruzzi et al. (1978). Agreement to better than 10% is obtained in all cases out to the muffin-tin radius. (8 refs.)

67435 Possibility of a spectral determination of the gap in the energy spectrum of alkali metals. I.I.Geguzin (Sci.-Res. Inst. of Phys., State Univ., Rostov-on-Don, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1627-8 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2868-70 (Sept. 1982). [received: April 1983]
The author shows that the contribution to the spectrum from transitions from the second band to the first band in alkali metals contains a divergence of the form $(\omega-\omega_g)^{-1/2}$, where ω_g is the energy gap between these bands on the surface of the Brillouin zone. (9 refs.)

Hydride stability and band structure of the components in the $Pd_{1-x}M_x$ and $LaNi_{5-x}M_x$ systems ....See Entry 67222

Electronic structure of palladium ....See Entry 67430

Core level shifts and valence change at the surface of intermetallic rare-earth systems ....See Entry 67741

Calculation of magnetic moment distributions in multilayered films ....See Entry 67973

Optical characteristics of Ni-Cr alloys in the solid and liquid states ....See Entry 68148

Dispersion relation E(k) for s and p bands of gold in the LQW direction ....See Entry 68413

71.25R Band structure of crystalline elemental semiconductors

67436 Magnetophonon oscillation in the conduction band and phonon-drag-enhanced magnetophonon peak of thermoelectric power of tellurium. K.Takita, K.O-hata, K.Masuda (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.244-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
At about 200K where the Hall coefficient of p-Te reverses its sign, magnetophonon oscillation of longitudinal magneto-Seebeck coefficient $(\partial^2\alpha_{//}/\partial B^2)$ is observed in $B//c$ and $B_{\perp}c$ by the use of the second derivative method. It is interpreted as a contribution of electron in the conduction band of Te. Effective mass values of the conduction band at 200K are deduced on an interpretation; $m^*_{\perp}=0.160\ m_0$ and $m^*_{//}=0.072\ m_0$. Below 20K on the other hand, a large peak is found at 3.2T in $-\delta^2\alpha_{//}/\delta B^2$ under $B//c$. The peak height is rapidly increasing with decreasing temperature by the phonon drag effect. The peak is interpreted as a resonant scattering peak by longitudinal acoustic (LA) phonon between the two valleys split off by 'inversion asymmetry splitting $\mu_B GB$', which gives $G=5.5$ in good agreement with $G=5\pm1$ determined by Shubnikov-de Haas experiment. (10 refs.)

67437 Anisotropic state filling in semiconductors. A.L.Smirl, T.F.Boggess, G.P.Perryman, A.Miller, B.S.Wherrett (Center for Appl. Quantum Electronics, North Texas State Univ., Denton, TX, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.389-91 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Picosecond self-diffraction measurements in germanium indicate that, for excitation levels in excess of 1 GW/cm², the authors observe the effects of anisotropic state-filling. A new theoretical model is outlined and agreement is found with all aspects of the data. (no refs.)

67438 Nonrelative dispersion relation in crystals with a diamond structure. A.A.Lipnik, K.Ya.Shtivel'man (Ternopol Pedagogic Inst., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.579-82 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.3-6 (July 1982). [received: May 1983]
The dispersion equations introduced in a previous paper (1982) are solved and the analytical expression of the dispersion relations thus obtained are investigated. The latter is in fair agreement with experiment for the heavy and light hole bands in the ⟨100⟩, ⟨110⟩ directions and for electrons of the lower conduction band in the ⟨100⟩ directions. An iteration procedure is proposed for the solution of the dispersion equations in arbitrary directions of the wave vector up to the Brillouin zone boundary. (18 refs.)

67439 Dispersion equation for crystals with diamond structure with spin-orbital interaction taken into account. A.A.Lipnik, K.Ya.Shtivel'man (Ternopol Pedagogic Inst., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.582-5 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.6-9 (July 1982). [received: May 1983]
Analytical expansion of the secular twenty-second order determinant is performed, in which the spin-orbital interaction between the upper valence zones is taken exactly into account in addition to the kp-interactions examined in previous papers (1982). A compact algebraic relativistic dispersion equation of eleventh degree is obtained which is suitable in the whole Brillouin zone. It is factorized on the axes of symmetry. In addition, the spin-orbital interaction between the conduction zones Γ_{15C} is taken into account on the axes ⟨100⟩. An iteration procedure is elucidated to solve the dispersion equation. (3 refs.)

Two-dimensional plasmons in hole space charge layers on silicon ....See Entry 67496

Plasmons, intersubband resonance and localization in inversion layers with periodically structured gate electrodes ....See Entry 67717

Cyclotron resonance and impurity absorption in tellurium under pressure in the submillimeter range ....See Entry 68029

Angular resolved photoemission of InSb(001) and heteroepitaxial films of α-Sn(001) ....See Entry 68407

71.25T Band structure of crystalline semiconductor compounds and insulators

67440 X-ray spectral study of iron phosphides. V.V.Nemoshkalenko, L.S.Voskrekasenko, V.V.Didyk, V.P.Krivitskii, L.I.Nikolaev, L.Ya.Solamatina, V.B.Chernogorenko (Inst. of Metal Phys., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.809-12 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.964-8 (June 1982). [received: Feb. 1983]
The occupied part of the valence band of iron phosphides consists of two partially overlapping subbands. The degree of overlap of these subzones decreases on transition from higher to lower phosphides. The low-energy subband is formed mainly by the 3s-states of phosphorous, with an admixture of states with p-symmetry with respect to iron atoms. The high-energy subband consists of a group of hybridised states of the crystal, with complex hybridisation. In this, subband states appear, which leads to Fe-Fe, Fe-P, and P-P bonds. In the crystal lattice of the phosphides, two types of Fe-P interaction take place: a weak one occurring in states with p-symmetry with respect of the iron atoms, and s-, p-symmetry with respect to phosphorus atoms, and a more vigorous interaction, occurring in states of all the principal types of symmetry with respect to iron and phosphorous atoms. (4 refs.)

67441 Electrophysical properties of transition metal oxides. I.G.Tkachenko, E.K.Fen.
Inorg. Mater. (USA), vol.18, no.6, p.822-5 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.979-82 (June 1982). [received: Feb. 1983]
The electric properties of oxides of d-transition metals were investigated and the mechanisms of their change with the number of electrons in the d-shell of an isolated metal atom were clarified. (21 refs.)

67442 Valence-band parameters and hole mobility of Ge-Si alloys—theory. K.Takeda, A.Taguchi, M.Sakata (Dept. of Instrumentation Engng., Keio Univ., Yokohama, Japan).
J. Phys. C (GB), vol.16, no.12, p.2237-49 (30 April 1983).
Using the Lawaetz method the authors have estimated the **k.p** band parameters and determined the band structure near the valence-band edge of the Ge-Si alloy system. They have also obtained the coupling constants between holes and phonons by Wiley's method. Using these two kinds of parameters they have calculated the time for relaxation of holes due to the lattice scattering, where they have taken into account the nonpolar optical phonon, the impurity scattering due to ionised and neutral centres and also the alloy scattering. The intervalence-band interactions are shown to produce the complicated temperature dependence of the hole mobility. (45 refs.)

67443 Energy gap dependance of the acceptor ionization energy induced by hydrostatic pressure at low temperature, near the SM-SC transition on $Hg_{1-x}Cd_xTe$. M.M.G.de Carvalho, C.Fau, M.Averous (Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.431-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors show that the acceptor energy ionization on $Hg_{1-x}Cd_xTe$ near the semimetal semiconductor transition varies differently under pressure (i.e. with the energy gap). Two behaviours are shown when $E_A\simeq5$ meV, E_A varies smoothly with P. For $E_A\simeq10$ meV, it varies very quickly with P. (11 refs.)

67444 Spin interaction enhanced anisotropy of the band overlap in $Hg_{.97}Mn_{.03}Te$. A.M.Sandauer, W.Dobrowolski, J.Kossut, R.R.Galazka (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.455-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The Hall effect and the conductivity of n-type $Hg_{1-x}Mn_xTe$ $(x=0.03)$ single crystals were studied at 2 and 4.2K in magnetic fields up to 6T. The Hall voltage is found to depend sensitively on the orientation of the magnetic field with respect to the crystallographic axes (B∥⟨100⟩ and B∥⟨110⟩). This fact is

interpreted in terms of the warping asymmetry which is enhanced by the exchange induced overlap of the conduction and the valence bands. Thus, magnitude of observed anisotropy of the Hall constant depends on the temperature. (8 refs.)

67445 Influence of exchange interaction on band structure of $Pb_{1-x}Mn_xTe$. J.Niewodniczanska-Zawadzka, G.Elsinger, L.Palmetshofer, A.Lopez-Otero (Inst. fur Phys., Univ. Linz, Linz, Austria), E.J.Fantner, G.Bauer, W.Zawadzki.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.458-60 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Magneto-optical and magneto-transport experiments have been performed on $Pb_{1-x}Mn_xTe$ crystals with $0<x<0.028$ grown by hot wall technique. The effective mass increase with Mn content has been established. A combined cyclotron-spin resonance has been observed, indicating semi-magnetic properties of PbMnTe. (12 refs.)

67446 Anomalous composition and temperature dependence of the energy gap of $AgGa_{1-x}In_xSe_2$ mixed crystals. Suk-Ryong Hahn, Wha-Tek Kim (Dept. of Phys., Chonnam Nat. Univ., Gwangju, Korea).
Phys. Rev. B (USA), vol.27, no.8, p.5129-31 (15 April 1983).
Lattice constants *a* and *c* were measured in the mixed crystals $AgGa_{1-x}In_xSe_2$ for $0 \leq x \leq 1$. They showed a miscibility region from $x=0.0$ to $x=0.4$ and from $x=0.8$ to 1.0, and then immiscibility near $x=0.6$ in the composition dependence of the lattice constants *a* and *c*. Also, the photoconductivity peak energy and the energy gap measured in the composition range from $x=0.0$ to 1.0 showed a discontinuity near $x=0.6$. The temperature coefficient of the photoconductivity peak energy is $(1.4\text{-}2.8)\times 10^{-4}$ eV/K and that of the energy gap $(2.3\text{-}3.8)\times 10^{-4}$ eV/K in the temperature range 25-75K. The sign of the temperature coefficient reverses and the values are $-(2.4\text{-}4.1)\times 10^{-4}$ and $-(2.4\text{-}5.1)\times 10^{-4}$ eV/K, respectively, in the temperature range 100-300K. (14 refs.)

67447 Anion displacements and the band-gap anomaly in ternary ABC_2 chalcopyrite semiconductors. J.E.Jaffe, A.Zunger (Solar Energy Res. Inst., Golden, CO, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5176-9 (15 April 1983).
Using a first-principles all-electron band-structure approach, the authors show that the anomalous (>50%) reduction in the band gaps of the $A^{I}B^{III}C_2^{VI}$ chalcopyrite semiconductors relative to their II-VI isoelectronic analogs results both from a pure structural effect (the anion displacements reflecting the mismatch of classical elemental radii) and from a purely electronic effect (*p-d* repulsion in the valence band), with a small coupling between the two factors. (20 refs.)

67448 A theoretical study of the *x*-dependence of the conduction-band density of states in metallic sodium tungsten bronzes Na_xWO_3. D.W.Bullett (School of Phys., Univ. of Bath, Bath, England).
Solid State Commun. (USA), vol.46, no.7, p.575-7 (May 1983).
Electronic structure calculations are reported for the cubic metallic bronze $NaWO_3$ and for WO_3 in its approximate cubic and real monoclinic structures. Within the composition range of the cubic bronzes Na_xWO_3 ($0.5<x<1$) the trends of rigid band model behaviour are approximately valid, but when little or no sodium is present the monoclinic distortions induce a significant increase in the semiconducting energy gap. (18 refs.)

67449 A study of the band structure of the $Co_{1-x}Cu_xCr_2S_4$ system of magnetic semiconductors by the diffuse reflection method. K.P.Belov, L.I.Koroleva, V.Yu.Pavlov, A.G.Temiryazev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1597-9 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2821-3 (Sept. 1982). [received: April 1983]
The authors present the results of a study of the diffuse-reflection spectra of powdered specimens of the $Co_{1-x}Cu_xCr_2S_4$ spinel system at room temperature, for the purpose of obtaining information on its band structure. The diffuse-reflection coefficient was measured using a single-beam arrangement in which the intensity of the light-reflected from the specimen and from a standard was measured alternately in the spectral range 0.5-2.3 eV. The experimental data were processed using the Kramers-Kronig rules. (4 refs.)

Elastic anomaly near zero-gap state in narrow-gap semiconductors ....See Entry 67116

Investigation of bandmasses and G-values by two-photon-magneto-absorption (TPMA) in ZnSe ....See Entry 67431

Diamagnetic excitons and parameters of energy bands of indium antimonide crystals ....See Entry 67474

On the conduction band anisotropy in semimagnetic semiconducting $(Cd_{1-x}Mn_x)_3As_2$ alloys ....See Entry 67652

The internal photoelectric effect in InSb with L-band participation ....See Entry 67681

Energy band-gap shift with elastic strain in $Ga_xIn_{1-x}P$ epitaxial layers on (001) GaAs substrates ....See Entry 67812

Modulation of the electrical conductance of phthalocyanine films by circularly polarized light ....See Entry 67821

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction ....See Entry 67877

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, $X=O$, S, Se ....See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te ....See Entry 67904

Virtual bound state model for the exchange interaction in semimagnetic semiconductors such as $Cd_{1-x}Mn_xTe$ ....See Entry 67914

Theoretical and experimental studies of uniaxial stress enhanced spin-flip transitions in n-InSb ....See Entry 68021

Optical reflectivity and band structure of black phosphorus .....See Entry 68158

Magneto-optics of cadmium arsenide ....See Entry 68181

Simple methods for analyzing interband magneto-optical data of Kane-type semiconductors: application to Cd_3As_2 ....See Entry 68183

Modulation-spectroscopy study of the $Ga_{1-x}Al_xSb$ band structure ....See Entry 68262

Optical pumping in PbTe epitaxial films ....See Entry 68311

Optical four-wave mixing spectroscopy of PbSe epitaxial layers ....See Entry 68345

Auger electron spectroscopy of TiO_2:inter- and intra-atomic transitions connected with the valence band ....See Entry 68368

Secondary electron spectroscopy study of valence and empty state density in CdS ....See Entry 68382

UPS, XPS and Auger spectroscopies of tetrathiotetracene (TTT) and bis (tetrathiotetracene)-triiodide (TTT_2I_3) organic semiconductor surfaces ....See Entry 68402

Angular resolved photoemission of InSb(001) and heteroepitaxial films of α-Sn(001) ....See Entry 68407

71.30 METAL-INSULATOR TRANSITIONS

67450 Substitution of TMTSeF with TMTTF in $(TMTSeF)_2ClO_4$: high pressure studies. S.S.P.Parkin, C.Coulon, D.Jerome (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), J.M.Fabre, L.Giral.
J. Phys. (France), vol.44, no.5, p.603-7 (May 1983).
$[(TMTSeF)_{1-x}(TMTTF)_x]_2ClO_4$ alloys have been studied under pressure for pressures up to 18 kbar through resistivity measurements. On substitution of TMTSeF in the superconducting compound $(TMTSeF)_2ClO_4$ with TMTTF a low temperature metal-insulator (M-I) transition is found at ambient pressure; above some critical pressure, P_c, the M-I transition is suppressed giving rise to a metallic state to the lowest temperatures considered in this study. The phase diagrams of the various alloys are of the same form although P_c increases with increasing TMTTF concentration. Superconductivity was not observed in any of these materials in the metallic high pressure regime. (27 refs.)

67451 Approaches for reducing the insulator-metal transition pressure in hydrogen. A.E.Carlsson, N.W.Ashcroft (Lab. of Atomic & Solid State Phys., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1305-8 (25 April 1983).
Two possible techniques for reducing the external pressure required to induce the insulator-metal transition in solid hydrogen are described. One uses impurities to lower the energy of the metallic phase relative to that of the insulating phase. The other utilizes a negative pressure induced in the insulating phase by electron-hole pairs, created either with laser irradiation or pulsed synchrotron sources. (27 refs.)

67452 Magnetic field induced nonmetal-metal transition in the open-gap $Hg_{1-x}Mn_xTe$. T.Wojtowicz, A.Mycielski (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.476-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Transverse and longitudinal magnetoresistance of p-type $Hg_{1-x}Mn_xTe$ crystals ($x=0.081$, 0.098, 0.11) were investigated in the temperature range 1.4K-300K and in magnetic fields up to 7 T. In the extrinsic and impurity conduction regime a strong negative magnetoresistance was observed. An experimental evidence for the magnetic field induced nonmetal-metal transition was obtained. The effects are discussed in terms of the theory of an acceptor state modified by the exchange interaction between holes and Mn^{++} ions. A role of the bound magnetic polaron localized on acceptor centre is also considered. (10 refs.)

67453 Charge density anomalies in Si and InSb preceding the high pressure transition. D.R.Yoder-Short, R.Colella, B.A.Weinstein (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.564-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The intensity of the (222) forbidden X-ray reflection in Si and InSb was measured as a function of high hydrostatic pressure. A few kbars prior to the pressure induced transformation to the metallic β-Sn structure the (222) intensity decreases sharply. This anomalous behaviour is interpreted as being due either to smearing of the valence bond-charge in anticipation of the metallic state, or to increased anharmonicity in the thermal vibrations. The role of zone boundary TA phonons is considered. (18 refs.)

67454 Study about the onset of intermediate valency in $TmSe_{0.32}Te_{0.68}$ under pressure. H.Boppart (Lab. fur Festkorperphys., ETH Zurich, Zurich, Switzerland), W.Rehwald, E.Kaldis, P.Wachter.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.573-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
In semiconducting $TmSe_{0.32}Te_{0.68}$ a pressure induced continuous transition to the metallic state takes place around 1.5 GPa. In order to study the variation of the elastic behavior through the transition the authors measured the ultrasonic sound velocities in the [100] and [110] directions as well as the specific volume up to 1.7 GPa. The softening of the longitudinal acoustic phonons and the bulk modulus is mainly caused by the negative elastic constant c_{12}. It appears that an appreciable mixture of 4f and 5d states must be present already in the semiconducting range leading to an 'intermediate valent semiconductor'. (11 refs.)

67455 Separable spectral model of the metal-insulator transition in Si:P. J.C.Phillips (Bell Labs., Murray Hill, NJ, USA).
Philos. Mag. B (GB), vol.47, no.4, p.407-18 (April 1983).
A two-fluid spectral model based on separable localized and extended states predicts that near but above threshold the impurity-band conductivity, σ, of a randomly doped semiconductor is proportional to $(\rho\text{-}\rho_c)^s$ where ρ_c is the critical density and $s(d)=(d-2)/2$ where *d* is the dimensionality. Localization, quantum and scaling theories have predicted $s(3)\sim 1$, $=0$ and $\geq 2/3$, respectively, whereas the present model gives $s(3)={}^1/_2$, in agreement with a hydrodynamic model and with recent experiments which give $s(3)=0.48\pm 0.07$. The theory is extended to predict $s^K(d)$, the conductivity index for compensated samples. The result is $s^K(d)=1({}^1/_2)$ for $d>2$ and *d* odd (even). This again is in good agreement with experiment, which gives $s^K(3)=1.15\pm 0.15$. (33 refs.)

67456 Localization and mobility edge in two-dimensional systems. I.P.Zvyagin (Faculty of Phys., Moscow State Univ., Moscow, USSR).
Philos. Mag. B (GB), vol.47, no.4, p.451-6 (April 1983).
The behaviour of the conductivity of two-dimensional systems, often interpreted using the concept of the mobility edge, is shown to be consistent with the scaling theory of localization. (12 refs.)

67457 X-ray diffuse scattering study of the organic one-dimensional conductor TMTTF-bromanil. S.Kagoshima, J.P.Pouget (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), T.Yasunaga, J.B.Torrance.
Solid State Commun. (USA), vol.46, no.7, p.521-5 (May 1983).
In the title compound, both $2k_F$ and $4k_F$ incommensurate lattice modulations were found by diffuse X-ray scattering. $4k_F$ streaks are observed at room temperature, below which the DC conductivity shows non-metallic behavior, but they do not turn into satellite spots at low temperatures. $2\ k_F$ broad spots develop rapidly below about 80K, the temperature below which the spin susceptibility vanishes and the electrical conductivity decreases more rapidly. It is suggested that the system may have a character intermediate between the Peierls and the spin-Peierls transitions. (30 refs.)

67458 Mott transition in layer semiconductors. Z.D.Kovalyuk, A.I.Seredyuk, K.D.Tovstyuk (Inst. of Problems in Materials Sci., Acad. of Sci., Chernovtsy, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1331-2 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2061-3 (Nov. 1982). [received: April 1983]
A longitudinal electric field was used to introduce Li and Pb impurity atoms into the interlayer spaces in InSe single crystals and the average distance between these impurities varied with the concentration. The investigation established that only atoms with s-valence electrons can be introduced readily into the interlayer space in InSe, whereas atoms with p and d-valence electrons form bonds with covalent layers and thus prevent penetration of an intercalant into van der Waals traps. The temperature dependence of the Hall coefficient was determined for 'pure' and intercalated crystals in the range 77-300K. Intercalation with lithium did not alter the nature of the temperature dependence of the hall coefficient but the carrier density decreased by one or two orders of magnitude. The subsequent intercalation of lead in concentration below 10^{18} cm^{-3} did not cause any significant changes, but at high intercalant concentrations, the nature of the dependence changed significantly. In this case it was characterized by the presence of three extrema. (4 refs.)

Band structure properties of one-dimensional donor-acceptor model polymers .... See Entry 67421

Ten years of X-ray diffuse scattering studies of one-dimensional conductors and superconductors .... See Entry 67570

Charge density wave transport in a novel inorganic chain compound, $(TaSe_4)_2I$ .... See Entry 67576

New results in transport phenomena in uncompensated n-type InSb with extremely low carrier density .... See Entry 67602

Semiconductor-metal transition in $Bi_{0.8}Sb_{0.2}$ alloys under tension .... See Entry 67703

Metal-nonmetal transition and superconductivity in amorphous $Si_{1-x}Au_x$ system .... See Entry 67709

Loss of dimensionality, localisation and conductance oscillations in n-type GaAs FETs .... See Entry 67710

Electronic excitations in K monolayer adsorbed on Si(100) 2×1 .... See Entry 67743

71.35 EXCITONS AND RELATED PHENOMENA

(inc. electron-hole drops)

67459 Triplet exciton lifetime under pressure in 'pure anthracene'. S.Arnold, N.Hassan (Dept. of Phys., Polytech. Inst. of New York, New York, NY, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5602-11 (1 May 1983).
The triplet exciton lifetime in 'pure' anthracene crystals is found to decrease by as much as a factor of 3 at room temperature under pressures up to 6.4 kbar and in a reversible fashion. Temperature measurement under pressure from 200 to 400K show that the effect is due to a state ~0.3 eV below the exciton band. Experiments with tetracene doped anthracene revealed that trapping by tetracene is increased by a factor of 2 over the same pressure range, indicative of enhanced diffusion. A comparison with the 'pure' anthracene effect reveals that pressure enhanced diffusion is insufficient for explaining this effect; the cross section for capture by the 0.3 eV state must change by more than a factor of 4 in going from 1 atm to 6.4 kbar. A triplet excimer is invoked for explaining the results, consistent with earlier work. The pressure dependence of the mean capture cross section for this species is determined. (15 refs.)

67460 The binding energy of excitons in polar crystals. Gu Shiwei (Dept. of Phys., Neimenggu Univ., Huhehot, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.12, p.1275-7 (Dec. 1982).
There is a great difference, sometimes as great as an order-of-magnitude, between the calculated values of the binding energy of excitons in polar crystals and the experimental ones. The author makes an improved calculation of the binding energy of excitons in TlBr, TlCl, ZnO and CuCl crystals. The results of the new calculation, especially those of ZnO, CuCl, are in better agreement with the experimental ones. (6 refs.)

67461 Excitons in a finite polymer chain. B.S.Tosic, G.S.Davidovic-Ristovski, Lj.M.Ristovski (Inst. of Phys., Novi Sad, Yugoslavia).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K1-4 (1 March 1983).
Frenkel excitons in a finite polymer chain, consisting of weakly interacting molecules, are considered. The continuum approximation is used, i.e. the long-wave excitons are taken into account only. The authors apply this approximation to the pure exciton system. It is shown that it leads to some unexpected results. (2 refs.)

67462 Faraday rotation in the lowest exciton resonance of gallium arsenide. Th.Hornung, R.G.Ulbrich (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.263-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reports Faraday rotation (FR) spectra of the exciton polariton resonance in high purity GaAs. The drastic variation of the group velocity around the lowest exciton n=1 leads to a giant resonance enhancement in the FR spectrum. The experimental data are explained quantitatively in a simple model within the polariton framework. It is possible to measure the product $g_{eff}.E_{LT}$ of the 1s exciton polariton resonance with high precision. In the low field region it is an excellent method to measure g_{eff} if E_{LT} is known. (11 refs.)

67463 Bound and free exciton states in InP. M.S.Skolnick, P.J.Dean (Royal Signals & Radar Establ., Great Malvern, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.266-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Photoluminescence (PL), PL excitation (PLE) and photoconductivity (PC) studies in the near band edge spectral region of InP are reported. Very well resolved donor bound exciton (D^0,X) lines are observed at low excitation intensity. Selective excitation of the (D^0,X) 'two electron' PL satellites is studied. A comparison is made between the relative strength of the different exciton features in PLE and PC. (14 refs.)

67464 Crystal field splitting of excitons bound to neutral complexes in GaP. H.P.Gislason (Dept. of Solid State Phys., Univ. of Lund, Lund, Sweden), B.Monemar, P.J.Dean, D.C.Herbert.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.269-71 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The characteristic spin-like singlet-triplet configuration of excitons bound to hole-attractive neutral associates in GaP results from a quenching of the hole orbital angular momentum in a local compressive axial strain field. A smaller crystal-field splitting of the multivalley degenerate electron states of excitons bound to such complexes is proposed to explain the additional BE states observed in several cases. Photoluminescence data on centres involving the hole-attractive substituents Cu_{Ga} and Sb_P serve as examples. (9 refs.)

67465 Instability of self-trapped exciton caused by hydrostatic pressure in AgCl. M.Kobayashi, Y.Ohno, S.Endo, K.Cho, S.Narita (Dept. of Material Phys., Osaka Univ., Osaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.272-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Recombination radiation spectra of self-trapped exciton in AgCl are investigated under hydrostatic pressure at 1.8K. With increasing the pressure the emission peak is found to shift toward the higher photon energy. The emission intensity decreases abruptly in the vicinity of 2.3 GPa and the peak disappears at more than 3.2 GPa. Observed instability of the self-trapped exciton is explained in terms of a configuration coordinate model. (7 refs.)

67466 Exciton dispersion in degenerate bands. M.A.Kanehisa (Lab. de Phys. des Solides, Univ. Pierre et Marie Curie, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.275-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The problem of separation into relative and translational degrees of freedom of the motion of an electron and a hole in a degenerate band, first considered by Dresselhaus (1956), is completely solved. The transformation from electron-hole variables into relative and translational variables is achieved by a linear transformation, which, by mixing valence subbands, eliminate all terms containing simultaneously the relative and the total momenta. The exciton masses are expressed explicitly in terms of the Luttinger band-structure parameters. Quantum-mechanical expression for the center of mass operator is also given. (9 refs.)

67467 Excitons in polar semiconductors. H.Buttner (Lehrstuhl fur Theoretische Phys., Univ. Bayreuth, Bayreuth, Germany), J.Pollmann.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.278-83 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A brief review of the main influences of the exciton-phonon interaction on exciton properties in polar semiconductors is presented. The authors make use of the great flexibility of the variational approach to the involved mathematical problem in order to be able to present a number of applications. The effects discussed range from binding energy shifts and corresponding changes of oscillator strengths, over exciton dispersion and phonon side bands to excitons in a magnetic field and quenching of diamagnetic shifts due to phonon- and anisotropy-influences. Finally, a short outlook is presented by discussing some results in nonlinear exciton-phonon dynamics. (48 refs.)

67468 Excitonic polarons and core excitons: dielectric relaxation and optical transitions. G.Iadonisi (Istituto di Fisica Teorica, Univ. di Napoli, Napoli, Italy), F.G.Bassani.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.284-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors study 'valence excitons' in interaction with longitudinal optical phonons and 'core excitons' in interaction with the valence electron-hole pairs. They use the effective mass approximation and include the interaction with a boson field by Frolich models. They compute the lowest exciton states by solving exactly the functional Eulerian equation for the distribution function of the boson coherent state. The relaxations of the boson field produce a screening of the electron-hole interaction and a polarization energy, which depends only on the ratios of the exciton to the polaron radii. Explicit calculations show cases with total, partial relaxation or without it. Higher energy states with the same electronic part of the wave function are also introduced. Optical transition probabilities to the excitonic states are computed in first order and give a distribution of the oscillator strength which depend on the boson distribution function of the coherent state. (13 refs.)

67469 Polaronic versus bare excitons: a functional-integration approach to the exciton-phonon problem. J.Adamowski (Solid State Phys. Dept., AGH, Krakow, Poland), B.Gerlach, H.Leschke.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.287-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors consider an exciton-LO-phonon system described by Frohlich's Hamiltonian. Making use of functional-integration techniques one can eliminate the phonon terms exactly leading to an effective two-particle system. They study the action functional of this system in limiting cases and establish a new upper bound on the ground-state energy. Furthermore, localization properties of the center of mass of the exciton are discussed. (9 refs.)

67470 The origin of the Urbach tail. A Monte-Carlo study of the exciton absorption lineshape. M.Schreiber, Y.Toyozawa (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.290-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A standardized formulation of the lineshape problem, i.e. the effect of lattice vibrations on the exciton absorption, is used in a Monte-Carlo-investigation of the direct and indirect absorption lines for different dimensionalities and temperatures. With respect to the low-energy tails the empirical Urbach rule is established. The analysis of the average-oscillator-strength-per-state (AOSPS) spectra allows the authors to unambiguously ascribe this behaviour to momentarily localized states. The introduction of a steepness index which can be determined from the calculated Urbach tails enables them to predict whether exciton self-trapping takes place. The predictions are in excellent agreement with various experimental observations. (9 refs.)

67471 Core excitons in semiconductors with a decaying core hole. G.Strinati (Istituto di Fisica 'G. Marconi', Univ. di Roma, Roma, Italy).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.293-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
It is shown that deviations from static electronic screening, in addition to contributing an increase of the core-exciton binding energy E_B, produce also a reduction of the core-exciton spectral width Γ as compared with the corresponding spectral width γ of the core hole alone. The occurrence of this effect

is interpreted as a fingerprint of dynamical screening since it cannot be obtained within the framework of a static theory. Numerical estimates for the Si 2p transition give about 70 meV for the difference γ-Γ, in qualitative agreement with experimental data. (14 refs.)

67472 Thermodynamical calculation of multiexciton complexes system in lightly doped Si: A contribution of excited states of the multiexciton complexes. A.L.Karuzskii, L.Yu.Shchurova, B.G.Zhurkin (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Solid State Commun. (USA), vol.46, no.3, p.247-9 (April 1983).
The authors propose the ideal equilibrium approximation for the study of multiexciton complexes system. The composition of the system is calculated using the shell model. The resulting temperature dependences of the complexes concentrations in Si:P agree with the known experimental data. They also stress the role of the contribution of excited states of the complexes. (8 refs.)

67473 Electron-hole droplets size at equilibrium. M.Combescot (Groupe de Phys. des Solids, Ecole Normale Superieure, Paris, France), C.Benoit a la Guillaume.
Solid State Commun. (USA), vol.46, no.7, p.579-82 (May 1983).
A finite lifetime τ implies that the liquid phase can only form droplets of finite size. Introducing this finite τ in the usual nucleation theory, one can obtain analytical expressions for the electron-hole droplet size, number and exciton density in the steady state, in the limit of large τ. This equilibrium size results, in fact, from a Maxwell construction using an appropriate chemical potential. (7 refs.)

67474 Diamagnetic excitons and parameters of energy bands of indium antimonide crystals. L.M.Kanskaya, S.I.Kokhanovskii, R.P.Seisyan, Al.L.Efros.
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1315-17 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2037-41 (Nov. 1982). [received: April 1983]
The authors investigate the diamagnetic exciton spectra of InSb crystals in order to obtain more information on the discrete structure of Wannier-Mott excitions[1]. They calculate accurately the binding energy of diamagnetic excitons as well as to give quantitative and qualitative interpretations of the spectra. The experiments were carried out on indium antimonide single crystals mainly of n-type conduction with an electron density and mobility $n=6.10^{13}$ cm^{-3} and $\mu=600000$ cm^2.V^{-1}.sec^{-1} at T=77K. (13 refs.)

67475 Relaxation of hot excitons in polar semiconductors. C.Trallero Giner, O.Soto-Longo Costa, I.G.Lang, S.T.Pavlov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1544-7 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2734-31 (Sept. 1982). [received: April 1983]
The probabilities of the 'normal' scattering W_s, of the scattering $W^{(n)}$ involving transitions to an excited state characterized by the principal quantum number n, and of the decay W_d of a hot Wannier-Mott exciton interacting with longitudinal optical phonons (*LO*) at finite temperatures are calculated. Computed results are obtained for arbitrary kinetic energies E_{kin} of an exciton including the effect of the Coulomb interaction between an electron and a hole. Moreover, the asymptotic behavior of W_s, $W^{(n)}$, and W_d is derived for kinetic energies $E_{kin} \gg \hbar\omega_{LO}$, where $\hbar\omega_{LO}$ is the energy of *LO* phonons. An approximate expression for $W^{(n)}$ in the limit $n \gg 1$ is also obtained. Actual calculations are carried out for CdS, CdTe, CdSe, and ZnTe. (22 refs.)

67476 Role of composition fluctuations in exciton spectroscopy of solid solutions of semiconductors. A.G.Plyukhin, L.G.Suslina (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1551-5 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2738-46 (Sept. 1982). [received: April 1983]
Experimental studies of exciton reflection, exciton-phonon luminescence, and resonant Raman scattering spectra of solid solutions of II-VI compounds are used to analyze the role of composition fluctuations of the solid solution in these effects. Two mechanisms for the interaction of excitons with the fluctuating field of the solid solution lattice are compared: localization of excitons with low kinetic energy by the potential wells of the random lattice field, and elastic scattering of free excitons by fluctuational distortions of the lattice. Analysis of the frequency dependences of the resonant Raman effect indicates that elastic scattering of excitons is important in many-phonon Raman scattering processes. It is shown that the probability of elastic scattering of excitons by static lattice distortions in solid solutions of II-VI compounds may become comparable with the probability of scattering by longitudinal optical phonons and make a significant contribution to the homogeneous broadening of the exciton states. (11 refs.)

67477 Drift of excitons in nonuniformly illuminated crystals. V.N.Strekalov (Machine-Tool Inst., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1640-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2894-7 (Oct. 1982). [received: April 1983]
A study is made of gradient or boundary effects which result in the appearance of forces exerted by phonons or free electrons on various crystal imperfections in a spatially nonuniform optical field. The example of excitons is used to illustrate a possible application of such forces to displace imperfections in crystals. (6 refs.)

Self-induced transparency with the participation of excitons and biexcitons in semiconductors .... See Entry 66353

Kinetics of polariton luminescence .... See Entry 67480

Two-photon K-space spectroscopy to determine the mixed-mode polariton dispersion in AgGaS$_2$ .... See Entry 67481

Exciton polaritons in monoclinic zinc diphosphide .... See Entry 67482

Dimensional effect in optical spectra of anthracene crystals .... See Entry 68167

Magnetooptical study of semimagnetic alloys Cd$_{1-x}$Mn$_x$Te .... See Entry 68182

Interference spectra of magnetic polaritons .... See Entry 68184

Resonant Raman scattering at the indirect triplet exciton in AgBr in high magnetic fields .... See Entry 68211

High-resolution resonance Brillouin scattering and the effect of stress on GaAs .... See Entry 68249

Non linear optical transmission of CdSe .... See Entry 68259

Role of the excitonic intermediate resonance in two-photon spectroscopy of CdS crystals .... See Entry 68266

Optical orientation and exciton alignment in an HgI$_2$ crystal . See Entry 68289

The impurity-induced luminescence of RbMnF$_3$ .... See Entry 68297

Excitation and temperature dependence of the excitonic emissions in undoped and Mg-doped VPE InP .... See Entry 68299

Luminescence of excitons bound by disorder-potential fluctuations in CdS$_{1-x}$Se$_x$: spatial diffusion, excitation level dependence, and kinetics .... See Entry 68303

Complex isotope splitting of the no-phonon lines associated with exciton decay at a four-lithium-atom isoelectronic centre in silicon .... See Entry 68304

Efficient visible luminescence from hydrogenated amorphous silicon .... See Entry 68313

Ortho- to para-exciton conversion in Cu$_2$O: a subnanosecond time-resolved photoluminescence study .... See Entry 68319

Influence of the state of the surface on the low-temperature luminescence spectra of strongly excited ZnTe crystals .... See Entry 68322

Optical resonance cooling of the nuclear spin system in a semiconductor with an anisotropic *g* factor .... See Entry 68324

Impact ionization of exciton states and the Stark effect in pure CdS crystals .... See Entry 68327

Resonance interaction between high-power ultrashort pulses of light with semiconductors .... See Entry 68367

Growth of epitaxial CdTe films in the Cd(CH$_3$)$_2$-(CH$_3$)$_2$Te-H$_2$ system .... See Entry 68453

71.36 POLARITONS

(inc. photon-phonon and photon-magnon interactions)

67478 Surface polariton reflection and radiation at end faces. R.F.Wallis, A.A.Maradudin (Dept. of Phys., Univ. of California, Irvine, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.764-6 (1 May 1983).
A theoretical investigation has been made of surface polariton reflection and radiation at the end face of a metal slab. Dielectric materials of dielectric constants ϵ_d and ϵ_d' lie above and beyond the end of the metal slab, respectively. Energy transmission and reflection coefficients have been calculated for a surface polariton incident on the end face of the metal slab for various slab thicknesses when $\epsilon_d=\epsilon_d'=1$ and $\omega_p/\omega=4$. The energy reflection coefficient has also been investigated as a function of ϵ_d with $\epsilon_d'=1$. The angular distribution of the radiation pattern has also been studied for two different ϵ_d. (8 refs.)

67479 Applications of surface polaritons for vibrational spectroscopic studies of thin and very thin films. G.N.Zhizhin, E.A.Vinogradov, M.A.Moskalova, V.A.Yakovlev (Inst. of Spectroscopy, Acad. of Sci., Moscow, USSR).
Appl. Spectrosc. Rev. (USA), vol.18, no.2, p.171-263 (1982-1983).
Studies of the surface state of solids, their detection, and studies of the surface transition layers including oxide films, physi-, and chemisorbed monomolecular films, their transformations at phase transitions and their chemical reactions have stimulated the development of a series of new methods. The nondestructive character of optical methods, their sensitivity to molecular structure and to the nature of chemical bonding, makes them very attractive for use. The main problem with optical methods is that their signal-to-noise ratio is often very low because the small thickness of films inevitably yields small signal changes in absorption, emission, or scattering of light. So, in order to accumulate signals for increasing the sensitivity of methods, it is necessary to find new physical procedures and to obtain new tools for use in thin film spectroscopy. This is one of the main developments in optical spectroscopy over recent years. They include computer accumulation systems with ordinary slit spectrometers and with Fourier transform spectrometers, emission spectrometry in possitive and negative light fluxes, enhanced Raman scattering, photoacoustic spectroscopy, reflection-absorption spectroscopy, and multireflection systems. In this sense the new facilities show promise in their applications to surface phonon-polaritons and plasmon-polaritons for optical spectroscopic studies of thin films on the surfaces of solids. The surface polaritons and plasmons being localized on the surface are extremely sensitive to the presence of thin films. (112 refs.)

67480 Kinetics of polariton luminescence. V.V.Travnikov, V.V.Krivolapchuk (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
JETP Lett. (USA), vol.36, no.6, p.242-5 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.196-8 (20 Sept. 1982). [received: April 1983]
A manifestation of exciton kinetics has been studied experimentally in the shape of the polariton luminescence spectra for the first time. The spectral shape depends on the exciton lifetime. The basic factors determining the shape are identified. (11 refs.)

67481 Two-photon K-space spectroscopy to determine the mixed-mode polariton dispersion in AgGaS$_2$. D.Frohlich, K.Reimann (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.392-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors report the observation of mixed mode exciton polaritons in AgGaS$_2$ by two-photon absorption. By changing the magnitude of the total K-vector and its direction with respect to the crystalline axis they are able to resolve resonances on the upper polariton as well as on the pure longitudinal exciton. The results can be quantitatively explained by the polariton theory for uniaxial crystals. (11 refs.)

67482 Exciton polaritons in monoclinic zinc diphosphide. R.S.Berg, P.Y.Yu (Dept. of Phys., Univ. of California, Berkeley, CA, USA), T.Mowles.
Solid State Commun. (USA), vol.46, no.2, p.101-4 (April 1983).
A classical theory based on excitons is insufficient to explain the reflectivity spectra of β-ZnP$_2$. Instead an exciton polariton picture is invoked and the polariton parameters are determined. Photoluminescence spectra are consistent with the polariton interpretation. Higher energy states of the exciton have been observed and from these the band gap and exciton binding energy in β-ZnP$_2$ have been deduced. (13 refs.)

67483 Effect of a temperature gradient on the spectra of A_1 polaritons in lithium niobate. V.S.Gorelik, L.G.Reznik, B.S.Umarov (S.U. Umarov Physicotech. Inst., Acad. of Sci., Dushanbe, Tadzhik SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1803-4 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3176-8 (Oct. 1982). [received: April 1983]
The authors report the first study of the effect of temperature gradients on the polariton Raman scattering spectra in lithium niobate. (9 refs.)

Diffraction of light by a bigrating: Surface polariton resonances and electric field enhancements .... See Entry 66211

Faraday rotation in the lowest exciton resonance of gallium arsenide .... See Entry 67462

Theory of amplification and instabilities of surface polaritons in semiconductors .... See Entry 67731

Interference spectra of magnetic polaritons .... See Entry 68184

High-resolution resonance Brillouin scattering and the effect of stress on GaAs .... See Entry 68249

Non linear optical transmission of CdSe .... See Entry 68259

71.38 POLARONS AND ELECTRON-PHONON INTERACTIONS

(for electron-phonon interactions in lattices, see also 63.20K)

67484 Theoretical analysis of optical-phonon deformation potentials in semiconductors. A.J.Hernandez-Cabrera, J.Sanchez-Dehesa, C.Tejedor (Dept. de Fisica del Estado Solido, Univ. Autonoma de Madrid, Cantoblanco, Spain).
J. Phys. C (GB), vol.16, no.12, p.2251-9 (30 April 1983).
A method to compute the electronic and structural properties of semiconductors self-consistently is applied to analyse the electron-phonon interaction in these crystals. The authors have calculated the optical-phonon deformation potentials along the symmetry directions in Si, Ge and GaAs. Their results confirm the previous ones obtained in more simplified approaches. Quantitative discrepancies with experimental data suggest what must be the next step to be taken in the theoretical effort. (20 refs.)

67485 Instabilities of polarons in high magnetic fields. F.M.Peeters, J.T.Devreese (Dept. Natuurkunde, Univ. Instelling Antwerpen, Wilrijk, Belgium).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.567-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The free energy of a polaron in a magnetic field is calculated. Feynman's polaron theory (1955) is extended to take into account the anisotropy of the effective electron-phonon interaction. In this approximation the polaron has an instability for certain values of the electron-phonon coupling strength (α), temperature (T) and magnetic field strength (H). It is suggested that this instability is connected with a discontinuous two-dimensional stripping of the polaron in the direction perpendicular to the magnetic field. (9 refs.)

67486 Cyclotron resonance studies of polarons and screening effects in GaAs. G.Lindemann, W.Seidenbusch, R.Lassnig, J.Edlinger, E.Gornik (Inst. fur Experimentalphys., Univ. Innsbruck, Innsbruck, Austria).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.649-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Polaron effects are studied in bulk n-GaAs by cyclotron resonance measurements under hot electron conditions. Good agreement between calculations and experiments is obtained. The Frohlich parameter determined is close to the literature value. An accurate treatment of polaron effects is necessary for the determination of the bandedge effective mass. In GaAs-$Ga_xAl_{1-x}As$ heterojunctions the influence of the free carrier concentration on the cyclotron resonance linewidth is investigated and screening is found to be ineffective. Polaron effects are weaker than determined in bulk samples. (7 refs.)

67487 The effective polaron mass in a gapless semiconductor HgTe. U.S.Pashabekova (V.I. Lenin State Pedagogical Inst., Baku, Azerbaidzhan SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1604-5 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2831-4 (Sept. 1982). [received: April 1983]
The author applies the method of Beni and Rice (1977) to the calculation of the polaron internal energy to the case of the HgTe band structure. The calculation is performed within the framework of the standard perturbation theory. (4 refs.)

Phase diagram of one-dimensional electron-phonon systems. II. The molecular-crystal model .... See Entry 67145

Excitonic polarons and core excitons: dielectric relaxation and optical transitions .... See Entry 67468

Polaronic versus bare excitons: a functional-integration approach to the exciton-phonon problem .... See Entry 67469

Polaron nature of charge carriers in silver azide .... See Entry 67635

Optical absorption from polarons in a model of polyacetylene .... See Entry 68163

A possible mechanism of light absorption .... See Entry 68176

Optical pumping of hot phonons in GaAs .... See Entry 68212

Spin-flip Raman scattering, bound magnetic polaron, and fluctuations in (Cd,Mn)Se .... See Entry 68226

Theory of free-electron optical absorption in n-InSb .... See Entry 68260

Soliton pair generation in polyacetylene: A lattice relaxation approach .... See Entry 68316

71.45 COLLECTIVE EFFECTS

67488 CDW phase transition in $NbSe_3$ and related compounds. J.Rouxel, A.Meerschaut, P.Gressier (Lab. de Chimie des Solides, Nantes, France).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.263-8 (March 1983).
Some basic features of CDW's instabilities are recalled. Then, $NbSe_3$ and some related compounds such as monoclinic TaS_3 and the (Fe-Nb)Nb_2Se_{10} series, are the basis of an experimental illustration of the concepts. $NbSe_3$ exhibits two CDW phase transitions at T_1 (145K) and T_2 (59K). The feature which makes $NbSe_3$ unique is the nonohmicity observed at very low electric field (few tenths of $mV.cm^{-1}$) just below T_1 and T_2. It is now well established that this nonlinear effect results from the depinning of a CDW, which carries a current. The conclusion is indicative of the role of the anion pairing in the triangular base of the trigonal prism, of the cation pairing along the chain and of the interchain coupling. (36 refs.)

67489 Theory of discommensurations and re-entrant lock-in transition in the charge-density-wave state of 2H-$TaSe_2$. K.Nakanishi, H.Shiba (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1278-89 (April 1983).
Charge density wave (CDW) states of 2H-$TaSe_2$ are studied on the basis of Jacobs and Walker's free energy. Discommensuration (DC) structures are inspected in detail under the situation where the stable commensurate (C) states change from one to another as the interlayer coupling constant is increased. Numerical calculations, in which a sufficiently large number of harmonics are taken into account, exhibit double honeycomb, triangular and hexagonal DC structures. The formation mechanism of various DC structures is discussed and compared with McMillan's DC diagram. Crossing over between different DC structures is also studied. Phase diagrams in the temperature and interlayer coupling plane are constructed to explain the re-entrant lock-in transition of 2H-$TaSe_2$. In this connection a suggestion is made on the nature of the high pressure C state. (24 refs.)

67490 Quantum fluctuation of a dislocation in a two-dimensional Wigner crystal. M.Kawano (Faculty of Sci. & Technol., Keio Univ., Yokohama, Japan), K.Ohashi, Y.H.Ohashi, M.Fukuchi.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1298-305 (April 1983).
The authors have investigated the mean-square displacement of dislocation axis in a two-dimensional Wigner lattice and the results are applied to the effects of quantum fluctuations to a dislocation core. The core size is of the order of an inter-particle spacing. (14 refs.)

67491 Tunneling investigation of charge density wave energy gap in 1T-TaS_2. H.Ozaki, T.Mutoh, H.Ohshima, A.Okubora, N.Yamagata (Dept. of Electrical Engng., Waseda Univ., Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.590-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The charge density wave induced energy gap has been observed by tunneling measurements over the nearly-commensurate phase of 1T-TaS_2. The energy gap stays near 0.5 eV from 215K up to around 280K, and above this temperature it decreases with increasing temperature. In addition to the structures giving the energy gap, a group of peak structures connected with the charge density waves have been observed in the dI/dV vs. V curves of the tunneling junctions, though the origin of those is not clarified yet. Connections of the energy gap with the electronic properties of this material are discussed. (11 refs.)

67492 Ground-state energy of a two-dimensional charge-density-wave state in a strong magnetic field. D.Yoshioka, P.A.Lee (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4986-96 (15 April 1983).
The charge-density-wave state of two-dimensional electrons which occupy only the lowest Landau level is investigated. The previous Hartree-Fock calculation by Yoshioka and Fukuyama [J. Phys. Soc. Jpn. 47, 394 (1979)] is extended to include the higher harmonics of the density wave. The correction of the Hartree-Fock ground-state energy is calculated by second-order perturbation theory. Effects of higher Landau levels are also estimated. It is found that the ground-state energy is a smooth function of ν, the filling factor of the lowest Landau level. (14 refs.)

Time-dependent strandlike domains in the charge-density-wave states of $NbSe_3$: An effect not induced by electric field .... See Entry 67228

Shubnikov-de Haas oscillations in transition-metal pentatelluride .... See Entry 67429

Charge density anomalies in Si and InSb preceding the high pressure transition .... See Entry 67453

Effective correlation energy of the dangling bond in amorphous silicon .... See Entry 67541

Negative mobility in the extreme quantum limit of transverse galvanomagnetic conduction .... See Entry 67560

The electronic and magnetic properties of transition metal dichalcogenide intercalation complexes .... See Entry 67572

Charge density wave transport in a novel inorganic chain compound, $(TaSe_4)_2I$ .... See Entry 67576

Observation of Shapiro steps in the charge-density-wave state of $NbSe_3$ .... See Entry 67577

Spin-hot electrons in photoexcited p-type InSb .... See Entry 67628

Non-linear conductivity of monoclinic TaS_3 .... See Entry 67630

Observation of quantized Hall effect and vanishing resistance at fractional Landau level occupation .... See Entry 67657

Electron localization and the quantized Hall resistance in silicon inversion layers .... See Entry 67658

Electronic transition under pressure in the two-dimensional purple bronze $K_{0.9}Mo_6O_{17}$ .... See Entry 67707

Charge- and spin-density wave instabilities on ideal semiconductor surfaces .... See Entry 67722

Two-dimensional Wigner lattice in a magnetic field and in the presence of a random array of pinning centers .... See Entry 67734

Electron mobility and Landau level width modulation-doped GaAs-$Al_xGa_{1-x}As$ heterojunctions .... See Entry 67763

Thermomagnetic coefficients of inversion layer in high magnetic field .... See Entry 67791

Valley splitting and valley degeneracy in n-type silicon (110) inversion layers .... See Entry 67792

Oscillations of the cyclotron resonance linewidth with Landau level filling factor in GaAs/AlGaAs heterostructures .... See Entry 68026

Observation of oscillatory linewidth in the cyclotron resonance of GaAs-$Al_xGa_{1-x}As$ heterostructures .... See Entry 68028

NMR study of ^{181}Ta in the commensurate charge density wave state of 1T-$TaSe_2$ and 1T-TaS_2 .... See Entry 68041

Generalized electronic susceptibility and charge density waves in transition metal dichalcogenides .... See Entry 68219

71.45G Exchange, correlation, dielectric and magnetic functions, plasmons

67493 Ground state correlation in the two-dimensional polarized electron gas. P.M.Lam (Inst. of Theoretical Phys., Chinese Acad. of Sci., Beijing, China).
Z. Phys. B (Germany), vol.50, no.4, p.337-42 (1983).
The ground state energy and radial distribution functions of the polarized two-dimensional electron gas with valley degeneracy n_v=1 and 2 are calculated using the hypernetted-chain approximation with the effective correlation factor method for fermions. The paramagnetic susceptibility is calculated and compared with experiment for silicon inversion layers. (24 refs.)

67494 Plasmon excitation by Coulomb scattering of electrons in 2D systems. R.A.Hopfel, E.Gornik (Inst. fur Experimentalphys., Univ. Innsbruck, Innsbruck, Austria), A.C.Gossard, W.Wiegmann.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.646-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reports new far infrared emission experiments from radiative decay of two-dimensional plasma waves. The excitation is generated by a heating of the electron gas in the applied electric field. Local fluctuations of the charge density require for plasma wave excitation an additional momentum exchange,

which is provided by Coulomb scattering. Radiative decay of magnetoplasmon excitations is studied. The intensity drastically decreases with magnetic field, and the dispersion of the magnetoplasmon agrees with theory up to magnetic fields of 3.5 Tesla. (14 refs.)

67495 The dielectric screening and magnetic instabilities in an interacting electron gas. O.V.Dolgov, E.G.Maksimov, S.N.Rashkeev (Phys. P.N. Lebedev Inst., Moscow, USSR).
Solid State Commun. (USA), vol.46, no.2, p.151-3 (April 1983).
The values of a parameter r_s are investigated, for which (a) the static dielectric function becomes negative, (b) the transition into the spin polarized state takes place. (8 refs.)

67496 Two-dimensional plasmons in hole space charge layers on silicon. E.Batke, D.Heitmann, A.D.Wieck, J.P.Kotthaus (Inst. fur Angewandte Phys., Hamburg, Germany).
Solid State Commun. (USA), vol.46, no.3, p.269-71 (April 1983).
The authors have observed two-dimensional plasmons in hole space charge layers of silicon. On Si(110) surfaces the plasmon mass depends on the charge density and shows a significant anisotropy for different directions of the plasmon wavevector in the surface. The determination of the plasmon mass allows detailed informations on the anisotropic and nonparabolic 2-D bandstructure of hole space charge layers. (13 refs.)

67497 Self-consistent nonlocal potentials near planar surfaces. Z.Penzar (Inst. of Phys., Univ. of Zagreb, Croatia, Yugoslavia), M.Sunjic.
Solid State Commun. (USA), vol.46, no.5, p.385-8 (May 1983).
A new derivation of the self-consistent dynamically screened nonlocal Coulomb potential near a planar surface is presented, based on the integral equation approach. The exact solution is obtained without restrictions on the dynamical response of the solid (e.g. RPA in metals), the type of surface potential or electronic density profile, and without additional matching or boundary conditions. This makes the present approach particularly useful e.g. in the general discussion of model-independent screening phenomena at metal surfaces. The application to the calculation of matrix elements for electron and ion excitation of collective modes and electron-hole pairs is formulated, and the connection with the previous results discussed. (10 refs.)

67498 Static polarizability of metal clusters and the related blue shift of the dipolar surface plasmon. W.Ekardt, D.B.Tran Thoai, F.Frank, W.Schulze (Fritz-Haber-Inst., Berlin, Germany).
Solid State Commun. (USA), vol.46, no.7, p.571-4 (May 1983).
The blue shift of the dipolar surface plasmon of small metal clusters is studied with the use of sum rule techniques due to Lushnikov et al. (1965, 1974). The static polarizability needed for the application of this technique is obtained by solving Poisson's equation for the total electrostatic potential of a small metal particle placed in an external electric field. The screening properties of the metal electrons are described within the modified Thomas-Fermi approximation. The ground state charge density determining the local Thomas-Fermi wavenumber is obtained from a variational estimate of the total energy of the metal electrons. The static polarizability obtained is smaller than the classical value R^3 (where R is the cluster radius) but larger than the value following from the step density Thomas-Fermi approximation. Correspondingly, the surface plasmon frequency is blue shifted from its classical value but red shifted from its step-density value. The shift is strongly r_s-dependent, where r_s is the well known electron gas parameter. (20 refs.)

67499 Anomalous increase in the dielectric function of thin semiconducting films in contact with metals. A.A.Bugaev, Yu.M.Gerbshtein (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1606-7 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2834-6 (Sept. 1982). [received: April 1983]
The authors report an unusually large increase in the dielectric function ε of V_2O_5 and Si films in contact with various metals (Hg, Al, and a eutectic In-Ga alloy). The films were deposited by vacuum thermal sputtering (V_2O_5) and electron-beam heating (Si) on glass or sapphire substrates in a vacuum of 10^{-6} torr. The dielectric function ε was determined from the frequency interval $\Delta\omega$ between interference fringes in the reflection spectra of the films. In all three cases the change in ε due to contact with metals was qualitatively the same; the authors discuss the results for the Hg contacts. (5 refs.)

How can a particle absorb more than the light incident on it? .... See Entry 64611

Use of a perfectly conducting sphere to excite the plasmon of a flat surface. I. Calculation of the local field with applications to surface-enhanced spectroscopy .... See Entry 66183

Elastic anomaly near zero-gap state in narrow-gap semiconductors .... See Entry 67116

Surface plasmons on gratings: coupling in the minigap regions .... See Entry 67335

The dispersion relation of surface plasmons on rough surfaces; a comment on roughness data .... See Entry 67336

Applications of surface polaritons for vibrational spectroscopic studies of thin and very thin films .... See Entry 67479

Quantized Hall conductance and edge states: Two-dimensional strips with a periodic potential .... See Entry 67554

Relaxation of fast electrons in semiconductors at coupled plasmon-phonon oscillations .... See Entry 67583

Plasmons, intersubband resonance and localization in inversion layers with periodically structured gate electrodes .... See Entry 67717

Electronic excitations in K monolayer adsorbed on Si(100) 2×1 .... See Entry 67743

Intersubband plasmons of a semiconductor superlattice .... See Entry 67765

A real-space method for the calculation of the orbital susceptibility of simple metals and transition metals .... See Entry 67887

Optical transitions in oriented polyacetylene .... See Entry 68159

Microscopic theory of Raman and infrared spectra of transition metal dichalcogenides in CDW state .... See Entry 68215

Theory of electronic Raman scattering from n-KTaO$_3$ .... See Entry 68218

Theory of free-electron optical absorption in n-InSb .... See Entry 68260

Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals .... See Entry 68285

Electron-energy-loss spectroscopy of polydiacetylenes .... See Entry 68374

A novel technique for the identification of the surface plasmon in EELS .... See Entry 68375

Low energy electronic and vibronic excitations of semiconductor surfaces .... See Entry 68377

Low energy electron inelastic scattering at surfaces: application to Mg(0001) and (1100). I. The clean metal surfaces .... See Entry 68379

71.45J Fermi-Thomas model

Static polarizability of metal clusters and the related blue shift of the dipolar surface plasmon .... See Entry 67498

Electron structure and electrical conductivity of the interface in a semiconductor bicrystal .... See Entry 67582

71.45N Calculations of total electronic binding energy

(see also 61.50L Crystal binding)

67500 Analytic calculation of the structural properties of semiconductors. G.Mula (Istituto di Fisica, Univ. di Cagliari, Cagliari, Italy).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.579-81 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A semiclassical approximation is proposed for the calculation of the structure dependent part of the total energy. Its simplicity allows one to obtain analytic expressions for important quantities such as the equilibrium lattice constant and the bulk modulus. Detailed calculations have been made for the diamond-like semiconductors. No free parameter appears in the theory, for which the only input is from separately computed pseudopotentials. The accuracy of the results is not critically dependent on the details of the pseudopotential. The formalism is also suitable for the investigation of structural phase transitions. As an example an analysis is given of the zincblende to rocksalt phase transition. (12 refs.)

Molecular orbital calculation of several ices using the pseudolattice method .... See Entry 66923

Van der Waals interactions in the lattice of metallic chains ... See Entry 66925

Static and structural properties of III-V zincblende semiconductors .... See Entry 66967

Electronic structures of higher stage graphite intercalation compounds .... See Entry 67420

Electrophysical properties of transition metal oxides .... See Entry 67441

71.50 LOCALIZED SINGLE-PARTICLE ELECTRONIC STATES

(exc. impurities; for localisation in disordered structures, see 71.55J)

67501 Molybdenum chalcogenides: clusters, chains, and extended solids. The approach to bonding in three dimensions. T.Hughbanks, R.Hoffmann (Dept. of Chem., Cornell Univ., Ithaca, NY, USA).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1150-62 (9 March 1983).
A combined molecular orbital and crystal orbital analysis of system containing $Mo_{3n}X_{3n+2}$ (n=2, 3, 4, ∞; X=S, Se, Te) units is presented. The modes of packing Mo_6X_8, Mo_9X_{11}, and $Mo_{12}X_{14}$ clusters into crystals are explained in terms of the cluster frontier orbitals. Intercluster Mo-X bonds are seen to result from an interaction between chalcogen donor orbitals and the cluster LUMOs that are localized on Mo atoms residing in the 'square faces' of the clusters. Closed-shell electron counts for the clusters are elucidated. The relationship between the cluster frontier orbitals and surface states is discussed. Finally, relationships between the band structure of $(Mo_3X_3^-)_\infty$ chains and the finite cluster molecular orbitals are explained. (39 refs.)

67502 Magnetoresistive determination of localization effects in InSb. R.C.Dynes, T.H.Geballe, G.W.Hull,Jr., J.P.Garno (Bell Labs., Murray Hill, NJ, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5188-91 (15 April 1983).
The authors have made magnetoresistance measurements in samples of n-InSb in the temperature range 0.05-1.5K. The carrier densities of the samples studied were $\sim 3.1\times10^{14}$ and $2.7\times10^{13}/cm^3$. At low fields (<50G) the negative magnetoresistance is interpreted as being due to orbital effects, and a detailed comparison with theory is made. The strength of the observed effects with applied field H is 0.55 of that expected from theory. Interaction effects could explain the discrepancy. The inelastic scattering localization rate is determined to vary as T^3. (22 refs.)

67503 Self-localization of a conduction electron in magnetically ordered crystals. V.D.Lakhno (Sci.-Res. Computing Center, Pushchino, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1578-81 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2787-93 (Sept. 1982). [received: April 1983]
The conditions for the formation of self-localized states in antiferromagnets are analyzed. Criteria for the stability of such states are derived. Cases of weak and strong external magnetic fields are discussed. (8 refs.)

Quantized Hall conductance and edge states: Two-dimensional strips with a periodic potential .... See Entry 67554

Non-Ohmic conduction and weak localization in 1T-TaS$_2$ .... See Entry 67607

Magnetoresistance in weakly localized regime .... See Entry 67655

Electron localization and the quantized Hall resistance in silicon inversion layers .... See Entry 67658

Loss of dimensionality, localisation and conductance oscillations in n-type GaAs FETs .... See Entry 67710

Plasmons, intersubband resonance and localization in inversion layers with periodically structured gate electrodes .... See Entry 67717

Nonmetallic localization and interaction in one-dimensional (0.1 μm) Si MOSFETs .... See Entry 67794

71.55 IMPURITY AND DEFECT LEVELS

67504 Evidence that the gold donor and acceptor in silicon are two levels of the same defect. L.-A.Ledebo (Innovance AB, Lund, Sweden), Zhan-Guo Wang.
Appl. Phys. Lett. (USA), vol.42, no.8, p.680-2 (15 April 1983).
A photocapacitance method was used to monitor the time dependences of the occupation numbers for the gold-related donor and acceptor in silicon during optical excitation. The experimental data give strong evidence that the donor level corresponds to the +/0 transition and the acceptor to the 0/- transition for one single defect. (4 refs.)

67505 Defect nature of the 0.4-eV center in O-doped GaAs. D.C.Look, S.Chaudhuri (Univ. Res. Center, Wright State Univ., Dayton, OH, USA), J.R.Sizelove.
Appl. Phys. Lett. (USA), vol.42, no.9, p.829-31 (1 May 1983).
The authors have studied the $E_c-0.4$ eV center in O-doped GaAs by a combination of temperature-dependent Hall-effect measurements, spark-source mass spectroscopy, and secondary-ion mass spectroscopy. The conclusion is that neither O nor any other impurity can account for the 0.4-eV center; therefore, it is a pure defect. (20 refs.)

67506 A novel technique for studying electric field effect of carrier emission from a deep level center. G.P.Li, K.L.Wang (Device Res. Lab., Univ. of California, Los Angeles, CA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.838-40 (1 May 1983).
A new reverse-bias pulsed deep level transient spectroscopy technique (RDLTS) is reported for studying the electric field effect of carrier emission from a deep level defect. The technique uses a reverse-bias pulse whose duration controls the emission of the carriers from a narrow region. The electric field in the region is determined by the pulse height used. The subsequent transient signal due to the capture of carriers by the defect states in the narrow region, in contrast with the emission signal in conventional DLTS, was obtained. The technique is extremely simple to use and requires no additional equipment when using a conventional DLTS setup. Formulation of this approach and the experimental results using this technique were given to illustrate the validity and simplicity of the technique. (6 refs.)

67507 Crystal-field energy levels of $BeAl_2O_4:Cr^{3+}$. Wu Guang-zhao, Zhang Xiu-rong (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
Acta Phys. Sin. (China), vol.32, no.1, p.64-70 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The $^4T_2$, $^4T_1$, and ^2E levels of Cr^{3+} ion on the mirror-site in an alexandrite crystal are in relation to the laser operation of the material. The $^4T_2$ (or $^4T_1$) level splits into three sublevels. In order to determine the energy level diagram of Cr^{3+} ions in chrysoberyl, the splitting of the $^4T_2$ and $^4T_1$ are calculated. The authors discuss the anisotropic transition intensities of corresponding absorption bands and finds a method to fit the spectra. Furthermore, the values of the parameters K_1 and K_2 that represent the magnitude of the splitting are obtained, and the crystal field energy level diagram of $BeAl_2O_4:Cr^{3+}$ (II), labelled by the irreducal representations of point group C_s, is given. (10 refs.)

67508 Influence of odd parity crystal field on level splitting of Ce^{3+} ions. Yang Gui-Lin, Xu You, Chu Da-Ping, Xue Deng-Ping, Zhai Hong-Ru (Dept. of Phys., Nanjing Univ., Nanjing, China).
Acta Phys. Sin. (China), vol.32, no.2, p.259-66 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The authors calculate the influence of *5d-4f* mixing caused by odd parity crystal field on level splitting of Ce^{3+} ions in CaF_2 and SrF_2 lattices. Results indicated that odd parity crystal field effect on level splitting may be fairly large. For lower levels in CaF_2 the contribution of odd parity crystal field may amount to 15-30%. The order of 1st and 2nd excited states even reverses. On the other hand, it has been shown that configuration mixing is one of the possible mechanisms causing the extension of radial wave functions of ions in crystal. (8 refs.)

67509 Different strategies of approach to the problem of local defects in crystals. C.Pisani (Inst. of Theor. Chem., Univ. of Turin, Torino, Italy).
THEOCHEM (Netherlands), vol.10, p.35-48 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The perturbed crystal and perturbed cluster approaches to the problem of local defects in crystals are critically compared: in the two cases the host crystal solution and the isolated cluster solution respectively are taken as a useful intermediate quantity to which suitable correction operators are applied. Particular attention is given to the case where system-specific, non-complete basis sets are adopted. Recent results obtained by applying the two methods to a simple model system are briefly discussed. (19 refs.)

67510 Thermal donors in silicon: consistent interpretation of Hall-effect and capacitance transient spectroscopy. W.Keller, K.Wunstel (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Appl. Phys. A (Germany), vol.A31, no.1, p.9-12 (May 1983).
Thermal donors are generated in oxygen-rich silicon by an anneal at 450°C. The energy-levels of these donors are investigated by capacitance transient spectroscopy (DLTS) and the Hall effect. A level at 125 meV below the conduction band observed with DLTS exhibits a strong dependence on the electric field (Poole-Frenkel effect). Evaluation with a novel model for the Poole-Frenkel effect leads to a corrected zero-field energy of 200 meV for this level. The Hall effect indicates two thermal donors at 57 and 120 meV below the conduction band; both centers cannot be observed with the capacitance-DLTS method due to the Poole-Frenkel energy reduction by 70 meV ± 10 meV. The 45 meV current-DLTS level is shown to correlate with the 120 meV Hall level. (14 refs.)

67511 Study of impurity states in a *n-n* GaAs-AlGaAs heterojunction using cyclotron resonance and Shubnikov-de Haas experiments. H.Sigg, H.W.Myron, P.Wyder (Res. Inst. for Materials & High Field Magnet Lab., Univ. of Nijmegen, Nijmegen, Netherlands), D.A.Poole, M.Pepper, R.W.Glew.
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.637-46 (1982).
The electronic structure of two *n-n* GaAs-AlGaAs heterojunctions is studied using far-infrared cyclotron resonance and Shubnikov-de Haas effect. Shallow impurity states, similar to the so called 'hydrogenic' impurities, are found in both systems. It is found that these impurity states lead to a freezing out of electrons from the conduction band with decreasing temperature. (9 refs.)

67512 Electronic structure of the divacancy in silicon. R.G.Humphreys (Royal Signals & Radar Establ., Malvern, England), S.Brand, M.Jaros.
J. Phys. C (GB), vol.16, no.12, p.L337-43 (30 April 1983).
The vacancy and divacancy (V_2) in silicon are assumed to be strongly coupled to the lattice via a linear Jahn-Teller process. Consequently, the lattice coordinate of the defect should strongly reflect the defect charge state. The authors report experimental and theoretical evidence which shows that the thermal broadening of the $V_2^+ \rightarrow V_2^0 + h$ optical transition is too small to be compatible with the above model. It would appear that the Jahn-Teller effect is relatively weak, and that the lattice coordinate of the defect is independent of charge state. (23 refs.)

67513 Excited states of double donors in silicon. M.Altarelli (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.122-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A calculation of the binding energy of excited states of an electron bound to a substitutional +2e point charge in Si is presented. Direct and umklapp intervalley interactions are included. Very large valley-orbit splittings for 1s and 2s levels are obtained, whereas p-like and ns levels ($n \geq 3$) are well described by one-valley effective-mass theory. The spectrum is in fair agreement with recent experiments on chalcogen donors. (12 refs.)

67514 Electronic structure of self-interstitials and sp-bonded interstitial impurities in semiconductors. J.P.Vigneron, M.Scheffler, S.T.Pantelides (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.137-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors report parameter-free self-consistent pseudopotential Green's-function calculations of the electronic structure of self-interstitials in Si at tetrahedral sites and of P and C interstitials in GaP, also at the tetrahedral sites. They find that the number, relative energy positions, and wavefunction character of the localized states of deep interstitials are strikingly similar to those of deep substitutional donor impurities and explain this result in terms of simple physical considerations. In the case of the Si self-interstitial, the results are significantly different from earlier results of Extended-Huckel calculations. The authors find no deep states in the energy gap, which provides a natural explanation of the fact that self-interstitials at tetrahedral sites have not been detected by either EPR or DLTS. The results have also motivated a reinterpretation of experimental data on the migration of self-interstitials. (12 refs.)

67515 Oxygen in gallium phosphide—a canonical deep donor. P.J.Dean (Royal Signals & Radar Establ., Great Malvern, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.140-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The classical description (CD) and major dissenting interpretations (DI) of the properties of the ultra-deep donor O_p in GaP are reviewed. Two charge states of isolated O_p exist, as well as associates with a wide variety of acceptor-like impurity species. Accurate information on energy levels, state symmetries, vibronic coupling and ionisation cross-sections is available from optical data, and upon concentrations and capture cross-sections from electrical capacitance spectroscopy. Radiative and non-radiative recombinations both occur through O_p, the latter including both multi-phonon and Auger processes. Thus, this single system uniquely provides illustrations of all major electronic processes of interest at deep states. All substantive properties can be interpreted through CD where the properties of O_p are described by a straightforward extension from the behaviour of the familiar shallow donors. The need for and validity of some of the major DI is examined. (30 refs.)

67516 The electronic states of oxygen in gallium phosphide. T.N.Morgan (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.146-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Existing theoretical models do not account for a number of important electronic properties of oxygen in GaP. The author describes a new (MO) model based on spin multiplets formed from the four neighboring gallium bond orbitals and show that it provides a detailed explanation of these properties in terms of spin- and k-conserving one-electron transitions. (9 refs.)

67517 Dissociation of (Zn,O) pairs in GaP. R.M.Feenstra, T.C.McGill (California Inst. of Technol., Pasadena, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.149-51 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The athors have observed photoinduced reactions in which nearest-neighbor (Zn,O) pairs in GaP dissociate, and subsequently re-form as further separated pairs. From reaction rate measurements, they find that the dissociation is induced by electron-hole recombination at the defect. A theoretical analysis is presented of the vibrational modes which may be involved in the reaction. (18 refs.)

67518 Auger effect at localized impurities in semiconductors. J.M.Langer, A.Suchocki, Le Van Hong, P.Ciepielewski, W.Walukiewicz (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.152-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Theoretical and experimental investigation of the Auger effect at localized impurities are presented. Theoretically estimated Auger coefficients well agree with that found experimentally for Mn^{2+} and Gd^{3+} in conducting CdF_2 crystals. (4 refs.)

67519 Physical properties of the deep X electron trap responsible for long time persistent photocapacitance in CdS. M.Housin, M.Fialin, G.Sagnes, G.Bastide, M.Rouzeyre (Centre d'Etudes d'Electronique des Solides, CNRS, Univ. Sci. et Technol. du Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.155-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Describes the main physical properties of a very deep electron trap which is responsible for the long time persistent photocapacitance of Schottky diodes on undoped CdS single crystals. TSCAP and DLTS have been used to determine the apparent thermal activation energy $E_a=0.925$ eV and the apparent electron capture cross section $\sigma_\infty=5.5\times10^{-15}$ cm^2 of these centers. Photocapacitance measurements have been performed at various temepratures to allow the determination of the spectral dependence of the photoionisation cross section. The deduced optical threshold E_n° of the 'bound state to the free conduction band state' transition is 2.5 eV. This transition gives a long tail absorption near the fundamental edge which is unambiguously identified by the thermal emptying of the X centres. The large difference between $E_a+0.925$ ev and $E_n^\circ=2.5$ eV is explained in the large lattice relaxation model. These values are consistent with the results of experiments which locate the X centres, under quasi-equilibrium conditions, at 0.87 eV below the conduction band. They also agree with the results of direct measurement of the thermal activation energy of the electron capture cross section $E_B=0.2$ eV. The low temperature quenching of both electron emission and capture is responsible for very large persistent photocapacitance effects which suggest that these X centres are acceptor like and probably correlated with cadmium vacancies. (12 refs.)

67520 Transition metal impurities in InP: defect complexes and native defects. A.Sibille, E.V.K.Rao, A.Mircea (CNET, Bagneux, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.176-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Transition metal elements are introduced into InP and the induced deep levels are studied. A Mn related electron trap is detected, possibly due to a complex like Mn_{In}-Vp. Cu introduces several deep levels for which a tentative identification of the centers involved is Cu_{In}, Cu_{In}-donor, Cu_{In}-Vp. (14 refs.)

67521 Electronic structure of substitional 3d transition atom impurities in silicon. A.Zunger, U.Lindefelt (Solar Energy Res. Inst., Golden, CO, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.185-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reports the results of a self-consistent calculation within the local density approximation for all the substitutional 3d transition atom (TA) impurities in an extended silicon host crystal using the quasi band Green's function method. Chemical trends in the gap state energies and 3d-like resonances are discussed as well as trends in the effective electronic configuration of TA impurities. An explanation for the remarkable property that many different charged states of TA impurities exist in the narrow band gap, despite the fact that the corresponding ionized states of the free TA span a range of ~60 eV, is proposed. (2 refs.)

67522 Deep levels in semiconductors—influence of hydrostatic pressure. W.Jantsch (Johannes Kepler Univ., Linz, Austria), K.Wunstel, O.Kumagai, P.Vogl.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.188-90 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Isothermal transient capacitance measurements provide a simple and yet extremely sensitive tool for the determination of pressure coefficients of deep level energies. Results for the chalcogen donors S, Se and Te in Si are in good agreement with predictions from the semiempirical model by Hjalmarson et al. (1980). In contrast to the chalcogen donors, the levels of interstitial Fe, Mn, V and Ti in Si move towards the valence band under pressure. A qualitative explanation is given for this anomaly. (13 refs.)

67523 Pairs of intrinsic defects in III-V semiconductors electronic states and interaction energies. T.L.Reinecke (Naval Res. Labs., Washington, DC, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.194-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electronic properties of pairs in intrinsic defects involving vacancies and antisites in the III-V systems GaAs, GaP, AlAs, InP, and InAs are studied. The electronic states of these defect pairs as well as the total electronic interaction energies between the two defects are evaluated. Calculations are performed using the recursion method and are based on tight-binding Hamiltonians. (9 refs.)

67524 Dynamical theory of recombination-enhanced defect reactions. H.Sumi (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.197-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Violent lattice vibrations around a deep-level defect triggered by nonradiative capture of an injected minority carrier enhance greatly defect reactions such as movement and production of a defect during thermalization of them. The capture occurs at a critical value of a configuration coordinate Q_1 while the reaction occurs when another one Q_2 exceeds a critical value. The capture gives rise to a damped oscillation of Q_2 when Q_2 is not perpendicular to Q_1 in the phonon-coordinate space. When the total vibration energy deposited upon capture is E_i, the activation energy of reaction is reduced from its thermal-equilibrium value E_A to E_A-E_i for $E_i<g^2E_A$, to $(\sqrt{E_A}-g\sqrt{E_i})^2/(1-g^2)$ for $g^2E_A<E_i<E_A/g^2$, and to zero for $E_i>E_A/g^2$, where g represents the direction cosine between Q_1 and Q_2. (10 refs.)

67525 Study of ideal vacancies in CdS and CdSe in the wurtzite structure. K.Tchakpele, J.P.Albert, C.Gout (Centre d'Etudes d'Electronique des Solides, Univ. Sci. et Technol. du Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.200-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electronic states of ideal vacancies in CdS and CdSe are calculated using a Green function method. First, the electronic band structure of these compounds is computed within a tight-binding approximation. It is then shown that cation vacancies may induce bound states inside the fundamental gap while the anion vacancies are found to behave as acceptors yielding a deep level situated at 0.35 eV (0.45 eV) above the valence band in CdS (CdSe). (10 refs.)

67526 Impurity states in n-type $Hg_{1-x}Cd_xTe$ in high magnetic field and under hydrostatic pressure. A.Raymond, J.L.Robert, D.S.Kuriakos (Centre d'Etudes d'Electronique des Solides, Univ. Sci. et Technol. du Languedoc, Montpellier, France), M.Royer.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.428-30 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have recently shown (ref. unob.) that the magnetic freeze-out can be observed in narrow gap $Hg_{1-x}Cd_xTe$ alloys ($0.18\leq x\leq 0.34$). For the less doped samples the existence of a resonant level is clearly pointed out. This level is responsible for a large trapping of the electrons when the magnetic field increases. The application of a hydrostatic pressure confirms the existence of this level: in zero magnetic field, when the pressure increases, the conductivity decreases strongly and then varies with a smaller slope. This implies a strong decrease of the free carrier density in the low pressure range and a change in the conduction process. They observed an activated conduction from a hydrogenic donor. (no refs.)

67527 The exchange contribution to the binding energy of acceptors in CdMnTe. J.Jaroszynski, T.Dietl, M.Sawicki, E.Janik (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.473-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Results of measurements of the resistivity as a function of the temperature and composition of p-type $Cd_{1-x}Mn_xTe$ are reported. It is shown that at low temperatures the increasing of the binding energy with x originates from the formation of the bound magnetic polaron whereas at high temperatures from thermodynamical fluctuations of magnetization. (10 refs.)

67528 Quantitative measurements of magnetic polaron binding on acceptors in CdMnTe alloys. Tran Hong Nhung, R.Planel (Ecole Normale Superieure, Univ. Paris VII, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.488-90 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The acceptor binding energy is measured as a function of temperature and composition in $Cd_{1-x}Mn_xTe$ alloys, by time resolved spectroscopy. The bound magnetic polaron effect is measured and compared with a theory accounting for magnetic saturation and fluctuations. (11 refs.)

67529 A deep-impurity model for acceptors in silicon. G.Cerofolini (SGS, Milan, Italy).
Philos. Mag. B (GB), vol.47, no.4, p.393-405 (April 1983).
A new model for acceptors in silicon is proposed. This model assumes that the neutral ground state has sp^2 hybridization and that the chemical shift of the ionization energy is associated with the elastic energy involved in the $sp^2\rightarrow sp^3$ change in hybridization. This hypothesis involves significant changes in the description of both equilibrium and transport properties. (18 refs.)

67530 Energy shift of hydrogenic donors in a magnetic field due to electric and strain fields. P.A.Fedders (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4799-803 (15 April 1983).
Calculates the second-order shifts in the energies of the 1*s* and 2*p*-states of hydrogenic donors in a magnetic field due to electric fields and combination of electric and strain fields in a piezoelectric medium. The results are discussed as a possible explanation of different line shapes and linewidths associated with different donors as observed in photoconductivity experiments on GaAs. (13 refs.)

67531 Ground-state energy of a D^- ion in two-dimensional semiconductors. D.E.Phelps, K.K.Bajaj (US Air Force Wright Aeronaut. Labs., Avionics Lab., Wright-Patterson Air Force Base, OH, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4883-6 (15 April 1983).
The ground-state energy of a D^- ion (a donor impurity ion with two attached electrons) in a two-dimensional semiconductor is calculated using a variational approach and in two dimensions is found to be about -4.48 Ry. The ground-state energy of a -hydrogenic system in two dimensions is known to be -4 Ry. Thus the binding energy of a D^- ion, defined as the energy required to remove one of the two electrons from the D^- ion to infinity, is about 0.48 Ry. This is about 12% of the ground-state energy of a hydrogenic system in two dimensions. This is to be compared with the binding energy of a D^- ion in three dimensions which is 5.55% of the hydrogenic ground-state energy. The relevance of the results of the problem of a D^- ion in thin-quantum-well structures is discussed. (14 refs.)

67532 Electronic structure of substitutional chalcogen impurities in silicon. V.A.Singh (Solar Energy Res. Inst., Golden, CO, USA), U.Lindefelt, A.Zunger.
Phys. Rev. B (USA), vol.27, no.8, p.4909-23 (15 April 1983).
The authors report the results of a first-principles calculation of the electronic structure of substitutional, unrelaxed, and neutral chalcogen impurities (O),S, and Se) in silicon. They have employed the recently developed quasi band crystal-field defect Green's-function method. They find that whereas atomistic models predict that the binding energies of donor levels in semiconductors increase with the ionization potential of the free impurity atoms, a special enhancement of the screening in the solid predicts, for chalcogen impurities in silicon, a reversal in this order. Their results are in excellent agreement with recently reported optical excitation data available for Si:S and Si:Se. They demonstrate that whereas oxygen shows the expected *sp* bonding to the host crystal, sulfur and selenium exhibit also significant *d* bonding by utilizing their virtual *d* states. They discuss the relevance of effective-mass-type calculations to chalcogen impurities in the light of the results. (54 refs.)

67533 Impurities in semimetals. M.Ya.Azbel (Bell Labs., Murray Hill, NJ, USA).
Solid State Commun. (USA), vol.46, no.2, p.113-15 (April 1983).
Localization in semimetals and semiconductors strongly depends on the character of disorder. The resistance may decrease when the concentration of vacancies increases, and may be anomalously low for small size substitutions. (7 refs.)

67534 Influence from free-carrier tails in deep level transient spectroscopy (DLTS). E.Meijer (Dept. of Solid State Phys., Univ. of Lund, Lund, Sweden), L.-A.Ledebo, Zhan-Guo Wang.
Solid State Commun. (USA), vol.46, no.3, p.255-8 (April 1983).
DLTS spectra of deep level impurities in semiconductors often display anomalies such as zero offsets, steps or peaks with reversed signs. For a correct interpretation of the spectra it is important to understand those features. They are explained here, and shown to be related to the presence of free-carrier tails which extend into the depletion region of a semiconductor junction. Gold-doped silicon and the so-called *A*- and *B*-levels in GaAs are chosen for illustration of the effects. (13 refs.)

67535 Capacitance spectroscopy investigation of defects formed in *n*-type silicon by neutron irradiation. A.V.Vasil'ev, S.A.Smagulova, S.S.Shaimeev (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1279-81 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1983-6 (Nov. 1982). [received: April 1983]
The capacitance (deep-level transient spectroscopy) method was used to study *n*-type silicon subject to irradiation with reactor neutrons and a subsequent isochronous annealing to temperatures of ~700°C. Immediately after irradiation the spectrum of deep levels had three peaks, two of which were due to an *A* center (a level at $E_c-0.18$ eV) and a divacancy in the charge state $W^{=}$(a level at $E_c-0.23$ eV). The third peak was a composite of three levels: $E_c-0.34$, $E_c-0.39$ (W^-), and $E_c-0.44$ eV (*E* center). Annealing transformed the disordered regions created by neutrons and caused complex changes in the deep-level spectra: several new defect centers appeared as well as a 'broad' deep-level spectrum due to the superposition of many types of defect. The rates of introduction of vacancies were different in the matrix and the impurity-defect shells surrounding disordered regions. (9 refs.)

67536 Causes of a strong field dependence of the electron capture cross sections of deep impurity levels in a semiconductor with conduction band valleys of various energies. Yu.V.Vorob'ev (T.G. Shevchenko State Univ., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1312-13 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2033-5 (Nov. 1982). [received: April 1983]
The author investigates the possibility of interpreting the electron capture cross section of deep impurity levels on the basis of ideas relating to the Auger capture mechanism involving bound carriers. In this case, evidently, the energy state of the carriers may be of decisive importance; that is, the transfer of the electron to a higher valley may 'switch on' the Auger mechanism, which is capable of giving very large values of cross section. (5 refs.)

67537 Dependence of a hydrogen-like impurity spectrum on the magnetic field orientation in the crystal. Sh.M.Kogan, A.F.Polupanov (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1327-9 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2055-8 (Nov. 1982). [received: April 1983]
In cubic semiconductors with conduction electrons having an isotropic effective mass, the shallow donor impurity centers are hydrogen-like in the effective-mass approximation. The effective-mass approximation is not valid near

the impurity atom ('central cell') itself. The resolution achieved in the spectroscopic measurements makes it necessary to examine the dependence of the spectrum on the magnetic field orientation in the crystal as a result of the central cell correction. The authors include in the unperturbed Hamiltonian of the crystal-impurity system the field of the perfect crystal and the smooth part of the impurity potential, together with the magnetic field. (7 refs.)

67538 Some properties of trapping levels formed as a result of a high-temperature treatment of *n*-type Si. E.V.Astrova, V.B.Voronkov, A.A.Lebedev (A.F. Ioffe Physicotech. Inst. Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1339-40 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2074-5 (Nov. 1982). [received: April 1983]
Thermal defects characterized by the same temperature dependence of the rate of thermal generation of carriers give rise to electron trapping levels near the middle of the band gap. The authors consider some of the properties of these deep levels. Trapping levels were formed as a result of a high temperature heat treatment of n-Si. A study of the isothermal relaxation of the capacitance showed that the upper half of the band gap had two deep levels with fixed ionization energies E. When the diode structures were illuminated with light from a GaAs light-emitting diode, only the upper level captured holes at temperatures 77-160K and there was no charging of the lower level. (4 refs.)

67539 Optical properties of deep centers in semi-insulating ZnSe. E.J.Bawolek, B.W.Wessels (Dept. of Materials Sci. & Engng., Northwestern Univ., Evanston, IL, USA).
Thin Solid Films (Switzerland), vol.102, no.3, p.251-8 (22 April 1983).
Properties of deep levels in vapor-deposited ZnSe on GaAs have been investigated using transient photocurrent and steady state photocapacitance measurements. A metal/insulator/semiconductor structure was used in the study in which ZnSe formed the insulator. A single dominant deep level in the ZnSe having an energy of E_c-1.2 eV was observed over the spectral region 0.5-3.0 eV. The photoionization cross section of the trap at 1.5 eV and 295K is 7×10^{-16} cm^2. Trap concentrations in the range 10^{16}-10^{17} cm^{-3} were measured in the as-grown material. (16 refs.)

The optical absorption of F and F_H centres in cesium halides .... See Entry 66987

Kinetics of strain-induced reorientation of zinc-sulfide and zinc-selenide crystal structures .... See Entry 67097

Raman probe of the large wavevector TA phonon bottleneck in GaAs .... See Entry 67140

Anisotropy of electron impurity scattering in dilute Al(Li) .... See Entry 67427

One dimensional transport along dislocations .... See Entry 67571

New results in transport phenomena in uncompensated n-type InSb with extremely low carrier density .... See Entry 67602

Delocalization of H^--like impurity states and formation of band type impurity conductivity in semiconductors .... See Entry 67604

Activated hopping mobility of carriers in magnetic semiconductors .... See Entry 67616

Polaron nature of charge carriers in silver azide .... See Entry 67635

A model for photovoltaic centres in ferroelectrics .... See Entry 67683

Kinetics of charging of copper impurity centers in Ge during strong laser excitation .... See Entry 67693

Photoconduction in heavily doped compensated semiconductors .... See Entry 67694

Electronic structure of bulk and surface vanadyl oxygen vacancies in the layer compound V_2O_5 .... See Entry 67744

Potential applications of poly-silicon as an electronic-device material .... See Entry 67775

Determination of deep trap density in *n*-type epitaxial GaAs .... See Entry 67811

A study of impurities and traps in liquid phase epitaxial InP in relation to melt prebaking .... See Entry 67813

Electronic properties of microcrystalline silicon prepared in the glow discharge plasma .... See Entry 67815

The nature of the superconducting state in PbTe doped with thallium .... See Entry 67842

ESR studies of donor clusters in silicon .... See Entry 68015

Electronic spin of the Ga vacancy in GaP .... See Entry 68017

Cyclotron resonance and impurity absorption in tellurium under pressure in the submillimeter range .... See Entry 68029

Electronic configuration of copper ions in $Cd_{1-x}Cu_xCr_2Se_4$ ($x \leq 0.07$) .... See Entry 68076

ENDOR investigation of tellurium donors in silicon .... See Entry 68081

ENDOR investigation of Ni^{3+} in GaP .... See Entry 68082

Laser-induced magneto-optical transitions from deep levels in n-InSb .... See Entry 68180

Spin-flip Raman scattering, bound magnetic polaron, and fluctuations in (Cd,Mn)Se .... See Entry 68226

Quasilocal states in indium-activated alkali-halide crystals .... See Entry 68272

Fano resonances in sulfur, selenium and tellurium doped silicon .... See Entry 68276

Far-infrared magneto-dynamics of photoexcited electron system in gallium arsenide .... See Entry 68277

Derivative absorption spectroscopy of GaAs:Cr .... See Entry 68278

Zeeman spectroscopy of cobalt doped InP .... See Entry 68279

Compensation mechanism in Ni-diffused n-type GaP [optical absorption spectra] .... See Entry 68280

Additional structure in infrared excitation spectra of group-III acceptors in silicon .... See Entry 68282

The impurity-induced luminescence of $RbMnF_3$ .... See Entry 68297

Excitation and temperature dependence of the excitonic emissions in undoped and Mg-doped VPE InP .... See Entry 68299

Complex isotope splitting of the no-phonon lines associated with exciton decay at a four-lithium-atom isoelectronic centre in silicon .... See Entry 68304

Radiative recombination of deep centers in ZnSe:In .... See Entry 68305

Evidence for associated deep donor-shallow acceptor pair recombination for the EL2 emission band in GaAs .... See Entry 68306

Deep level optical spectroscopy of the levels introduced by transition metals in GaAs .... See Entry 68307

General trends in the luminescence properties of transition elements centres in III-V semiconducting compounds .... See Entry 68308

Decay scheme of 310 and 380 nm emission bands in NaCl:Pb system .... See Entry 68320

A donor-acceptor pair broad band emission in $AgGaS_2$ .... See Entry 68332

Glow curves of thermally pre-treated NaCl:Ca crystals .... See Entry 68335

71.55J Localization in disordered structures

67540 Electronic properties of doped polyacetylene. J.P.Albert, C.Jouanin (Centre d'Etudes d'Electronique des Solides, Univ. Sci. Tech. de Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.620-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A model calculation of impurity states in polyacetylene is presented. Two possible perturbations introduced by the dopant have been investigated, a localized and an extended one. The possibility of a soliton lying on the chain is considered and the interaction with the impurity is investigated according to their relative positions. The authors then study the electronic structure of polyacetylene at higher doping levels within the soliton lattice model. The closing of the gap is found to occur at a concentration of solitons of 7%. (6 refs.)

67541 Effective correlation energy of the dangling bond in amorphous silicon. D.Adler, F.R.Shapiro (Dept. of Electrical Engng. & Computer Sci., MIT, Cambridge, MA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.932-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The current theoretical and experimental situation with regard to the sign of the effective correlation energy of the dangling-bond defect in amorphous silicon-based alloys is reviewed. It is concluded that the defect could well have a negative effective energy if complete atomic relaxations occur. (19 refs.)

67542 Local structure and electronic states in hydrogenated amorphous silicon. B.Kramer, H.King (Phys.-Tech. Bundesanstalt, Braunschweig, Germany), A.MacKinnon.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.944-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Presents results for the local density of electron states, and the charge distribution in a cluster model of hydrogenated amorphous silicon. The authors use a Weaire-Thorpe type Hamiltonian, which was suitably modified to include the H-atoms. If the parameters in the Hamiltonian are taken so as to reproduce the H associated peaks in the valence bands, which are observed in photoemission, there is an average charge transfer from Si to H of −0.27 e in agreement with earlier findings on infrared, and proton magnetic resonance spectra. (13 refs.)

67543 Estimation methods for localized-state distribution profiles in undoped and phosphorous-doped *a*-Si:H. S.Furukawa, N.Matsumoto (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Phys. Rev. B (USA), vol.27, no.8, p.4955-60 (15 April 1983).
The effective temperature which characterizes the localized states of hydrogenated amorphous silicon (*a*-Si:H) has been obtained by measuring the space-charge-limited currents, photoconductivity dependences on the incident-light intensity, and transient photocurrents in a series of phosphorous-doped films. The effective temperatures obtained by those three methods coincide for the highly doped specimens. For the undoped specimens, however, the coincidence is not as good because of recombination effects. (13 refs.)

67544 Temperature dependence of electron-capture cross section of localized states in *a*-Si:H. H.Okushi, T.Takahama, Y.Tokumaru, S.Yamasaki, H.Oheda, K.Tanaka (Electrotech. Lab., Ibaraki, Japan).
Phys. Rev. B (USA), vol.27, no.8, p.5184-7 (15 April 1983).
A temperature dependence of the electron-capture cross section [$\sigma_n(E,T)$] of the gap states in *a*-Si:H was determined for the first time by isothermal capacitance transient spectroscopy. A bump was observed on the gap-state profile of lightly P-doped *a*-Si:H and $\sigma_n(E,T)$ increases as temperature increases. From this temperature dependence as well as the energy dependence of $\sigma_n(E,T)$ reported previously, it is concluded that the bump of gap-state profile is located approximately 0.5 eV below the conduction-band mobility edge and multiphonon emission predominates in the electron-capture process at the gap states near the bump. It is strongly suggested that the bump structure originates from doubly occupied dangling-bond states. (13 refs.)

67545 Studies of the gap states density in undoped and doped amorphous hydrogenated silicon. J.Kocka, M.Vanecek, J.Stuchlik, O.Stika, E.Sipek, H.T.Ha, Ha.A.Trisk (Inst. of Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.443-7
Density of the gap states in undoped and phosphorus and antimony doped n-type a-Si:H has been determined from the absorption coefficient measurement. A constant photocurrent method was used to determine the value of optical absorption in a low absorption region. A quantitative model has been suggested to determine the density of states (DOS) within a gap below the Fermi level from the spectral dependence of the absorption coefficient. The model is based on a Gaussian shaped maximum, connected with the dangling bonds, between the exponential valence and conduction band tails. The doping rises this maximum in the DOS. (14 refs.)

Doping of amorphous silicon by implantation of manganese ions .... See Entry 66849

Magnetoresistance in Anderson-localized systems .... See Entry 67553

The electrical conductivity of amorphous antimony and its dependence on film thickness .... See Entry 67611

Transient photocurrent behavior in amorphous semiconductors .... See Entry 67695

Metal-nonmetal transition and superconductivity in amorphous $Si_{1-x}Au_x$ system .... See Entry 67709

Electron localization and interaction in two-dimensional magnetic films .... See Entry 67808

Injection-stimulated blackening of As_2Se_3 films .... See Entry 67823

Local binding configuration of phosphorus in doped and compensated amorphous hydrogenated silicon .... See Entry 68075

Optically detected electron-nuclear double resonance in hydrogenated amorphous silicon .... See Entry 68080

Electron-energy-loss spectroscopy of polydiacetylenes .... See Entry 68374

71.70 LEVEL SPLITTING AND INTERACTIONS

(see also 75.10 – in magnetic phenomena, 75.30E Exchange and superexchange interactions, 73.20 Electronic surface states)

67546 Theory of order-disorder transitions for inhomogeneous mixed-valence systems. J.L.Moran-Lopez (Inst. fur Theoretische Phys., Freie Univ. Berlin, Berlin, Germany), P.Schlottmann.
Phys. Rev. B (USA), vol.27, no.8, p.5122-5 (15 April 1983).
A simple alloy-analogy model for inhomogeneous semiconducting mixed-valence compounds is extended to include the coupling of the long-range charge-order parameter to the lattice. For weak coupling to the lattice the order-disorder transition is of second order, while it is of first order in the case of strong phonon coupling. The authors calculate the entropy, the conductivity, and the thermal dilation close to the transition and discuss the results in view of recent experiments for Eu_3S_4. (7 refs.)

67547 Valence change of Sm ion in $Eu_{1-x}Sm_xSe$. K.Kojima, S.Nishizawa, K.Hiraoka, T.Hihara, T.Kamigaichi (Faculty of Integrated Arts & Sci., Hiroshima Univ., Hiroshima, Japan).
Solid State Commun. (USA), vol.46, no.5, p.417-18 (May 1983).
Crystallographic and magnetic investigations of $Eu_{1-x}Sm_xSe$ mixed crystals have been made. The x dependence of the lattice constant shows a deviation from the usual Vegard law and suggests an intermediate valence of Sm ions in EuSe host, which is about 2.3 for $x \leq 0.2$. The substitutive Sm ion influences magnetic properties of EuSe as a non-magnetic ion with smaller ionic radius than the Eu^{2+} ion. (7 refs.)

Photophysical properties of benzimidazole and thiabendazole and their homologues. Effect of substituents and solvent on the nature of the transition .... See Entry 66048

Study about the onset of intermediate valency in $TmSe_{0.32}Te_{0.68}$ under pressure .... See Entry 67454

High pressure thermopower and electrical resistance measurements in $CeSn_3$, $CeAl_3$, $CeAl_2$ and $CeIn_3$ .... See Entry 67569

The relaxation of electron-phonon system in the halogen bridged quasi-one-dimensional mixed-valence crystal .... See Entry 67579

Core level shifts and valence change at the surface of intermetallic rare-earth systems .... See Entry 67741

Intervalence excitations of a mixed-valence salt: NMR and optical absorption in molten $InCl_2$ .... See Entry 68058

Pressure and temperature dependence of the hyperfine fields of YFe_2, YFe_3 and YIG .... See Entry 68074

L_{III} X-ray absorption in the light rare earths: Ground-state versus final-state effects .... See Entry 68361

71.70C Crystal and ligand fields

67548 The cluster-lattice interaction in the calculation of the electronic structure of $CrF_6{}^{3-}$ in K_2NaCrF_6. Z.Barandiaran, L.Pueyo, F.Gomez Beltran (Dept. de Quimica Fisica, Univ. de Oviedo, Oviedo, Spain).
J. Chem. Phys. (USA), vol.78, no.7, p.4612-18 (1 April 1983).
The cluster-lattice interaction involving the $CrF_6{}^{3-}$ in K_2NaCrF_6 has been analyzed, in the way proposed by Pueyo and Richardson [J. Chem. Phys. 67, 3583 (1977)] by computing the lattice potential with the Ewald method and introducing an analytical representation of it in the cluster Fock matrix before self-consistency. Many different expressions have been tested in order to obtain the best representation of the Ewald results. All of them have been centered in the metal site. The partition of this interaction in core-lattice and valence-lattice portions reveals that the earlier procedure of centering the lattice potential function on the ligand site is inappropriate for improving the cluster in-vacuo calculation of the equilibrium metal-ligand distance. The new results go in the required direction, but the effects of the interaction are now uniformly small. These effects have been examined in several properties, including the 10Dq, the ground state vibrational frequency $\bar{\nu}(a_{1g})$, the horizontal displacement of the ${}^4T_{2g}$ with respect to the ${}^4A_{2g}$, the vertical Stokes shift associated with these two states and the ligand-to-metal charge transfer originated in the SCF process. (20 refs.)

67549 Calculation of crystal field theory of Mn^{3+} in piemontite. Xu Zitu, Zheng Chusheng, Peng Mingsheng (Guiyang Inst. of Geochem., Acad. Sinica, Beijing, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1199-203 (Nov. 1982). [received: April 1983]
Piemontite is a Mn^{3+}-bearing silicate mineral with neso-silicate structure. Isomorphism exists with epidote and clinozoisite. Space group $P2_1/m$. The structural formula may be written as $Ca_2(Al, Fe, Mn)O_6.AlO_4(OH)_2.Al_6.SiO_4.Si_2O_7$. Piemontite is different from epidote and clinozoisite mainly in that Mn^{3+} enters into the epidote structure and replaces a position of Fe^{3+} and Al, thus showing strong pleochroism. The pleochroism formula is: α=yellow, β=pink and γ=red. The authors measured the polarized absorption spectra of piemontite from the Shilu Iron Mine, Hainan Island on a refitted microscope-spectrophotometer. The spectral pattern is in agreement with that given by Burns (1967) from St. Marcel, Piemonte, Italy. Based on the spectral pattern and the structural data of Dollase (1969), the Mn^{3+} crystal field potential for piemontite can be calculated theoretically. The result of our calculation is in keeping with the experimental spectrum band and it has explained the occurrence of strong pleochroism in piemontite and the stability of Mn^{3+} ion in piemontite structure. (3 refs.)

67550 Electric field gradient of single impurities in aluminum. L.M.Kahn (Phys. Dept., Univ. of Rhode Island, Kingston, RI, USA), F.Perrot, M.Rasolt.
Phys. Rev. B (USA), vol.27, no.8, p.5110-12 (15 April 1983).
Single substitutional impurities of Mg, Zn, Ga, Ge, and Si in Al universely show very small electric field gradients at the second-nearest-neighbor sites, in obvious disagreement with theoretical calculations. The authors show that this does not likely reflect the neglect of nonspherical contributions to the induced charge density around the impurity. (18 refs.)

The lowest ${}^3E_u$ state of a metalloporphine in a crystal field of low symmetry. Directions of the stationary fields for electron spin resonance and phosphorescence Zeeman experiments .... See Entry 66040

Low temperature structural and magnetic properties of $PrPb_3$ .... See Entry 67189

Crystal field splitting of excitons bound to neutral complexes in GaP .... See Entry 67464

Crystal-field energy levels of $BeAl_2O_4:Cr^{3+}$ .... See Entry 67507

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Magnetic susceptibility calculations from crystal field theory for high spin ferric complexes of tetragonal character .... See Entry 67901

Magnetic and quadrupolar phase transitions in cubic rare-earth intermetallic compounds .... See Entry 67922

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Structural phase transition study of $NiCl_2H_2O$ by EPR .... See Entry 67996

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The EPR spectrum of neodymium in crystals of the scheelite series at high pressure .... See Entry 68010

ESR studies of donor clusters in silicon .... See Entry 68015

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Effect of relaxation on the Mossbauer hyperfine spectra of a Γ_8 quadruplet .... See Entry 68103

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Absorption spectrum of Cr^{3+} ion in $KAl(SO_4)_2.12H_2O$ .... See Entry 68258

Zeeman spectroscopy of cobalt doped InP .... See Entry 68279

Absorption spectrum of Cu^{2+} in strontium tartrate tetrahydrate .... See Entry 68284

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Characterization of luminescence centres in neodymium implanted zinc sulphide .... See Entry 68331

71.70E Spin-orbit coupling, Zeeman, Stark and strain splitting

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71.70G Exchange interactions

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Optical permittivity of a covalent crystal .... See Entry 68166

Spin-flip Raman scattering, bound magnetic polaron, and fluctuations in (Cd,Mn)Se .... See Entry 68226

71.70J Nuclear states and interactions

67551 Nuclear orientation of thermally prepared ${}^{114m}InCu$ by the brute-force method. J.Boysen, W.D.Brewer, A.Kettschau (Fachbereich Phys., Freien Univ. Berlin, Berlin, Germany).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.249-55 (Feb. 1983).
The authors report the results of brute-force orientation experiments on several alloys of ${}^{114m}InCu$ prepared by different thermal methods, with the goal of clarifying the origins of the deviations from the theoretical nuclear orientation effect reported by several groups for this system. In particular, using thin diffused samples they obtain essentially the same attenuation as previously reported for both ${}^{114m}In$ and ${}^{111}In$ implanted into Cu crystals and foils. Thicker diffused or melted samples show less or more attenuation, respectively. They find no evidence for thermal gradients between samples and thermometers as a cause for the observed deviations. (15 refs.)

67552 Effect of chemical structure on the electron density at the tellurium nucleus. E.Hartmann (Zentralinst. fur Isotopen- & Strahlenforschung, Akad. der Wissenschaften, Leipzig, Germany), M.Rysavy.
Hyperfine Interactions (Netherlands), vol.13, no.4, p.257-62 (Feb. 1983).
Reports results of a study in which the Xα-SW method is employed to deduce estimates of the differences in the electron densities at the Te nucleus in some compounds. On the basis of these estimates some assertions are deduced to the calibration problem of the Mossbauer nuclide ^{125}Te and to the chemical influence on the IC of the 35.5 keV M1+E2 transition in ^{125}Te. (38 refs.)

Amorphous to crystalline transformation of $Fe_{81}B_{13.5}Si_{3.5}C_2$ ....See Entry 66853

The heat capacity of single-crystal praseodymium below 1K ...See Entry 67230

Magnetic and quadrupolar phase transitions in cubic rare-earth intermetallic compounds ....See Entry 67922

Electron paramagnetic resonance and ENDOR studies of Cr^{3+}-Al^{3+} pairs in forsterite ....See Entry 68003

Superhyperfine interaction of an Nd^{3+} tetragonal center in a calcium fluoride single crystal ....See Entry 68009

ESR studies of donor clusters in silicon ....See Entry 68015

Anisotropy and asymmetry of the hyperfine spectrum of holmium in magnetically ordered RAl_2 alloys ....See Entry 68044

A deuterium NMR study of $D(UO_2XO_4)$, $4D_2O$; X=P, As .....See Entry 68045

NMR of ^{141}Pr in ferromagnetic $GdAl_2$ and $NdAl_2$ ....See Entry 68073

Optically detected electron-nuclear double resonance in hydrogenated amorphous silicon ....See Entry 68080

ENDOR investigation of tellurium donors in silicon ....See Entry 68081

ENDOR investigation of Ni^{3+} in GaP ....See Entry 68082

Internal magnetic hyperfine fields at Hf nuclei in iron, cobalt and nickel hosts ....See Entry 68089

Disparity between the transient hyperfine fields for Pt and Os in Fe; an electron vacancy sharing interpretation ....See Entry 68090

Temperature dependence of the hyperfine quadrupolar interaction in K_2ZrF_6 ....See Entry 68091

Magnetism and crystalline electric fields in $R_2Fe_3Si_5$ compounds ....See Entry 68102

Effect of relaxation on the Mossbauer hyperfine spectra of a Γ_8 quadruplet ....See Entry 68103

Optical resonance cooling of the nuclear spin system in a semiconductor with an anisotropic g factor ....See Entry 68324

72.00 ELECTRONIC TRANSPORT IN CONDENSED MATTER

(for surfaces, interfaces, and thin films, see 73.)

72.10 THEORY OF ELECTRONIC TRANSPORT; SCATTERING MECHANISMS

67553 Magnetoresistance in Anderson-localized systems. H.Kamimura, A.Kurobe, T.Takemori (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.652-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Magnetoresistance in the Anderson-localized regime is calculated by the percolation method, with a particular purpose of investigating the effects of electron-electron interaction on it. It is predicted that the interplay of the intrastate interaction and the energy dependence of localization lengths gives rise to the competition of positive and negative contributions in the field dependence of the magnetoresistance. Further, combined with the interstate interactions, the temperature change in the magnetoresistance of IT-TaS_2 and its alloy systems is explained satisfactorily. Finally, the correlation of the interaction effects on the variable range hopping in the absence and presence of a magnetic field is clarified. (13 refs.)

67554 Quantized Hall conductance and edge states: Two-dimensional strips with a periodic potential. R.Rammal, G.Toulouse, M.T.Jaekel, B.I.Halperin (Lab. de Phys., Ecole Normale Superieure, Paris, France).
Phys. Rev. B (USA), vol.27, no.8, p.5142-5 (15 April 1983).
The authors have investigated the energy levels of an electron in a periodic potential and a magnetic field, confined to a two-dimensional strip of infinite length but finite width, for two sets of boundary conditions. The bulk formula giving the quantized Hall conductance is explained in terms of a special gauge-invariance property of the edge states. This Communication clarifies the role of the geometry in the derivations of the quantized Hall effect. (11 refs.)

67555 Reduced problem of thermoelectricity for isotropic media. V.P.Bulat.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.459-60 (March 1983). In Russian.
Investigates the reduced problem of thermoelectricity for a planar isotropic medium. A solution is obtained which permits one to calculate the temperature fields of various thermoelements. (6 refs.) *V.G.P.*

Carrier drag by phonons in semiconductors having an arbitrary isotropic band ....See Entry 67585

72.15 ELECTRONIC CONDUCTION IN METALS AND ALLOYS

67556 Electrical and optical properties of polythiophene prepared by electrochemical polymerization. K.Kaneto, K.Yoshino, Y.Inuishi (Dept. of Electrical Engng., Osaka Univ., Osaka, Japan).
Solid State Commun. (USA), vol.46, no.5, p.389-91 (May 1983).
Electrical conductivities and optical absorptions of neutral and oxidized polythiophene films polymerized by the electrochemical method are reported. The electrical conductivity of polythiophene borofluoride film shows metallic value of ca. 100 S cm^{-1} at room temperature and decreases over 10^{10} times into semiconductive regime by the electro-chemical or chemical undoping. Absorption spectrum of polythiophene changes by the undoping from the characteristic of metal to interband transition with absorption edge ca. 2.0 eV and maximum absorption coefficient of $\sim 10^5$ cm^{-1} at 2.7 eV. (1 ref.)

72.15E Electrical and thermal conduction in crystalline metals and alloys

67557 Electrical conductivity and morphology of silicon in A-S13 and A-S7G. S.Jacob (Centre Tech. des Industries de la Fonderie, Paris, France), A.Remy.
Fonderie - Fondeur d'Ajourd'hui (France), no.22, p.33-41 (Feb. 1983). In French.
The morphological modification of silicon caused by sodium treatment leads to an increase of 20 to 30% in the electrical conductivity in the case of Al-Si13 and about 10% in the case of Al-Si7Mg. Structural hardening, spheroidization or annealing treatments also increase the electrical conductivity. The results obtained make it possible to consider favourably the checking of the structures of these alloys prior to casting by simply measuring the electrical conductivity, provided the test is carried out on an appropriate shop specimen. (10 refs.)

67558 Electrical resistivity of dislocations in metals. M.Kaveh, N.Wiser (Dept. of Phys., Bar-Ilan Univ., Ramat-Gan, Israel).
J. Phys. F (GB), vol.13, no.5, p.953-61 (May 1983).
An analysis is presented of the sample dependence of the specific dislocation resistivity ρ_D/N_D of metals. In contrast to the usual assumption, ρ_D/N_D is not taken to be independent of the dislocation density N_D present in the sample. The N_D dependence of ρ_D/N_D arises from the coupling between electron-dislocation scattering and electron-impurity scattering at low (liquid He) temperatures and from the coupling between electron-dislocation scattering and electron-phonon scattering at higher (liquid N_2) temperatures. The theory is applied to the extensive data available for ρ_D/N_D for Al at 4.2K and at 80K and for Cu at 4.2K, for which conflicting values for ρ_D/N_D have been reported by different workers. Good agreement is found between theory and experiment. (20 refs.)

67559 Concentration and temperature dependence of the electrical resistivity of quenched PdH_x. B.M.Geerken, R.Griessen (Naturkundig Lab., Vrije Univ., Amsterdam, Netherlands).
J. Phys. F (GB), vol.13, no.5, p.963-73 (May 1983).
The hydrogen concentration dependence of the electrical resistivity $\rho(x)$ of rapidly cooled PdH_x samples is investigated at 4.2K and 77.4K for $0 \leq x \leq 0.015$. The resistivity data show that the hydrogen atoms are homogeneously distributed in the host metal up to a concentration $x \approx 0.005$. In this regime $d_\rho/dx = 25$ $\mu\Omega$ cm. This value is reproduced by a simple model where scattering between electron states on the Γ sheet on the Fermi surface and between states on the Γ sheet and the d band jungle-gym is taken into account. This model leads to a maximum in $\rho(x)$ at $x=0.4$ for temperatures above the critical temperature $T_c=566$K of the PdH_x system. Below T_c (especially at 4.2K) the concentration dependence of ρ is dominated by the segregation in the α and α' phases for $0 \leq x \leq 0.65$. In this concentration range the experimental data can be described by assuming a random distribution of dilute α phase spheres in the α' phase PdH_x matrix. (25 refs.)

Self-interstitial atoms, vacancies and their agglomerates in electron-irradiated nickel investigated by diffuse scattering of X-rays ....See Entry 66983

T-P-C state diagram of the V-Mn system in the ordering range ....See Entry 67156

High pressure thermopower and electrical resistance measurements in $CeSn_3$, $CeAl_3$, $CeAl_2$ and $CeIn_3$ ....See Entry 67569

Electronic transport in metallic Ge:Sb at very low temperature ....See Entry 67608

Electron localization and interaction in two-dimensional magnetic films ....See Entry 67808

Size effects on electron transport in multifilament superconducting wires ....See Entry 67845

Variation of electrical resistivity in FeCo alloy on isochronal ordering ....See Entry 68537

72.15G Galvanomagnetic and other magnetotransport effects

67560 Negative mobility in the extreme quantum limit of transverse galvanomagnetic conduction. B.K.Ridley (Dept. of Phys., Univ. of Essex, Colchester, England).
J. Phys. C (GB), vol.16, no.12, p.2261-4 (30 April 1983).
A non-equilibrium delta-function distribution of carriers can move up the potential energy gradient associated with an electric field as a consequence of the energy dependence of the quasi-one-dimensional density of states, characteristic of magnetic quantisation. (7 refs.)

67561 Gadolinium-heavy rare earth alloys: preparation, metallographic study and extraordinary Hall effect. R.Asomoza, A.Fert, R.Reich (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.177-201 (April 1983).
The authors present a study of the extraordinary Hall effect (EHE) in gadolinium containing rare earth impurities. The alloys were melted in an argon atmosphere (in sealed tantalum crucibles) or in a dynamic vacuum (in tantalum crucibles with a delayed leak). The Hall effect measurements show that the EHE induced by rare earth impurities in gadolinium is the sum of a skew scattering contribution proportional to the impurity resistivity $\Delta\rho_0$ and a side jump term proportional to $\Delta\rho_0{}^2$. The dependence of the EHE on the rare earth impurity indicates that it is mainly due to spin-orbit coupling of the conduction band (rather than to orbital exchange) and the authors develop an appropriate method to interpret their results. By extending their model to the EHE of the pure rare earth metals, they show that it arises mainly from side jump scattering and they present a quantitative interpretation of the EHE of pure gadolinium. (36 refs.)

67562 On the possible relation between the absence of superconductivity in Au and Pd-Ag alloys and the negative sign of the Hall coefficient. I.M.Chapnik (Dept. of Phys., Univ. of London, London, England).
J. Phys. F (GB), vol.13, no.5, p.975-8 (May 1983).
Available data are presented which support the supposition that metals and alloys with a negative low-temperature Hall coefficient are apparently not superconducting. (18 refs.)

67563 Field dependence of the galvanomagnetic coefficients in lead single crystals. H.Sato, Y.Imai, K.Yonemitsu (Dept. of Phys., Tokyo Metropolitan Univ., Tokyo, Japan).
J. Phys. F (GB), vol.13, no.5, p.1071-9 (May 1983).
The authors have measured the transverse magnetoresistance and the Hall coefficient of lead single crystals for the field along the [100] and the [110] axes. Emphasis has been placed on their field dependence and on their temperature dependence in the intermediate-field range. The field-dependent galvan-

omagnetic coefficients have also been computed by path integration based on the 4 OPW Fermi surface model. The agreement between experiment and the computation is very good, though some discrepancies remain for the field along the [110] axis in the high-field range. At lower temperatures, some deviation from Kohler's rule is found in the low-field Hall coefficient. (27 refs.)

67564 Investigation of magnetic films by the anomalous Hall-effect. G.Bergmann (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.68-73 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
Magnetic moments scatter conduction electrons asymmetrically and yield the anomalous Hall-effect (AHE). This method has been applied to measure the suppression of the magnetism of Ni on top of different non-magnetic metals. Ni looses its magnetic moments on polyvalent metals such as Mg, In and Sn up to thicknesses ranging between 2 and about 3 atomic layers whereas on top of the noble metals it already shows magnetic moments for thicknesses of 1 atomic layer of Ni. Fe on top of the polyvalent metals Sn, In and Pb shows with increasing coverage between 2% of a monolayer and 1.6 monolayer a transition from magnetically free moments via a two-dimensional spin glass to a ferromagnetic state. The magnetic behavior of Fe on top of a Pd, surface suggests a reduced Stoner enhancement of the Pd surface, compared with the bulk Pd. (37 refs.)

67565 Magnetoresistivity of amorphous alloys containing rare earths. D.Eichler (Inst. Le Bel, Univ. Louis Pasteur, Strasbourg, France), J.C.Ousset, S.Cantaloup, A.Berrada, J.Durand.
J. Phys. Colloq. (France), vol.43, no.C-9, p.671-5 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Reports the results of low-temperature anisotropic magnetoresistivity ($\Delta\rho_A$) measurements in moderate steady field (up to 45 kG) and in high pulsed field (up to 300 kG) on various series of amorphous alloys containing non-S state Rare-Earths (RE). For $RE_{80}Au_{20}$ alloys, $\Delta\rho_A$ is negative for all the heavy RE. For $RE_{67}Co_{33}$ alloys, $\Delta\rho_A$ in moderate field exhibits between Ho and Er the change of sign expected for dominant contribution from RE quadrupole scattering. But, in high field, $\Delta\rho_A$ becomes negative as for amorphous $RE_{80}Au_{20}$. For dilute $La_{80-x}RE_xAu_{20}$ alloys (x being a few %), the quadrupole contribution to $\Delta\rho_A$ is unambiguous. From the field and temperature behavior of $\Delta\rho_A$, the nature of the ground state for Pr, Nd, Tb, Dy and Tm in amorphous $La_{80}Au_{20}$ is discussed together with an estimate of the energy gap between the ground state and the first excited states. (19 refs.)

67566 Temperature dependence of the Hall coefficient of CuBe2 between 6 and 300K. S.Feid, V.Groger, F.Stangler (Tieftemperaturphys., Inst. fur Festkorperphys., Univ. Wien, Wien, Austria).
Z. Metallkd. (Germany), vol.74, no.4, p.246-9 (April 1983). In German.
Samples of CuBe2 have been annealed at 325°C for different aging times resulting in differing defect structures as GP-zones and γ'-precipitates. The temperature dependence of the low field Hall coefficient of these samples is investigated between 6 and 300K. The maximum ratio of inclination for every curve except the sample with the highest matrix concentration varies according to the anisotropy change confirming also for this case the validity of the two group model for dilute alloys. Thus the temperature dependence of the aged samples confirms, that the observed decrease of the Hall coefficient with growing temperature can be ascribed to the anisotropy change due to γ'-phase formation. (13 refs.)

Shubnikov-de Haas oscillations in transition-metal pentatelluride .... See Entry 67429

Quantized Hall conductance: effect of random potentials .... See Entry 67649

Surface impedance of thin plates during bilateral electromagnetic field excitation .... See Entry 67746

72.15H Thermomagnetic effects

Thermoelectric and magnetothermoelectric quality factors of bismuth and solid solutions of the bismuth-antimony system .... See Entry 67567

72.15J Thermoelectric effects

67567 Thermoelectric and magnetothermoelectric quality factors of bismuth and solid solutions of the bismuth-antimony system. V.S.Zemskov, A.D.Belaya, P.G.Borodin (A.A. Baikov Inst. of Metall., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.7, p.974-7 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1154-7 (July 1982). [received: Feb. 1983]
The alloy $Bi_{85}Sb_{15}$ has the highest thermoelectric quality factor (at 100K, ZT=0.62). At 180-210K, the thermoelectric quality factors of alloys containing 3-10 at.% of antimony are practically equal. The highest increase in the thermoelectric efficiency in a magnetic field is that observed in the alloys $Bi_{86}Sb_{14}$ and $Bi_{85}Sb_{15}$ (the value of ZT for these alloys is 1.4 at 180 and 164K in magnetic fields of 1.2 and 1 T respectively). (10 refs.)

67568 Magnetic thermoelectric power of $Fe_{20}Ni_{60}B_{10}Si_{10}$ metallic glass. K.Pekala, M.Pekala, R.Trykozko (Inst. of Phys., Warsaw Tech. Univ., Warsaw, Poland).
Solid State Commun. (USA), vol.46, no.5, p.413-15 (May 1983).
The magnetic contribution to the thermoelectric power was separated for the metallic glass $Fe_{20}Ni_{60}B_{10}Si_{10}$ which exhibits the ferro-paramagnetic transition at T_c=455K remarkably below the crystallization threshold T_x=670K. Results are compared with the predictions of the Kasuya theory (1959). (20 refs.)

67569 High pressure thermopower and electrical resistance measurements in $CeSn_3$, $CeAl_3$, $CeAl_2$ and $CeIn_3$. V.Vijayakumar, S.N.Vaidya (Chem. Div., Bhabha Atomic Res. Centre, Bombay, India), E.V.Sampathkumaran, R.Vijayaraghavan.
Solid State Commun. (USA), vol.46, no.7, p.549-51 (May 1983).
The thermopower and electrical resistance of $CeSn_3$, $CeAl_3$, $CeAl_2$ and $CeIn_3$ are reported as a function of pressure at room temperature. The thermopower curves of $CeSn_3$, $CeAl_3$ and $CeAl_2$ exhibit maxima at about 25, 40 and 80 kbar respectively. These maxima are attributed to the occurrence of continuous valence transitions of Ce ions in these compounds. No such transition is observed in $CeIn_3$ in the pressure range of investigation. (19 refs.)

Reduced problem of thermoelectricity for isotropic media .... See Entry 67555

Disorder effects in the linear chain compound TiS_3 .... See Entry 67578

72.15L Relaxation times and mean free paths

Size effects on electron transport in multifilament superconducting wires .... See Entry 67845

72.15N Collective modes, e.g. in one-dimensional conductors

67570 Ten years of X-ray diffuse scattering studies of one-dimensional conductors and superconductors. R.Comes (Lab. de Phys. des Solides, Univ. de Paris Sud, Orsay, France).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.269-71 (March 1983).
Competing effects in real one-dimensional conductors have considerably enriched the original structural picture of the instability of a single metallic chain. Such effects include transverse as well as longitudinal polarizations of the Peierls distorsion, instabilities on different molecular chains, 2 and 4 k_F instabilities, and commensurability effects. In the more recent class of organic superconductors $(TMTSF)_2X$, superconductivity is not only in competition with the Peierls instability but also with order-disorder phase transitions involving the noncentrosymmetric counter ions. (34 refs.)

67571 One dimensional transport along dislocations. R.Labusch (Inst. fur Angewandte Phys., Clausthal, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.203-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Dislocations in most semiconductors are straight on an atomic scale due to the existence of a high Peierls potential. Consequently, bound states in the dislocation core are expected to have the properties of one-dimensional quantum mechanical systems. In the first part the possibility of one dimensional metallic conduction is discussed, taking into account knowledge of the core structure of the relevant dislocation typyes, as well as recent theoretical of their core states. In the second part the prospects of experimental detection of one dimensional conduction along dislocations in semiconductors are discussed and examples are given in which the experimental proof of one dimensional conduction has been claimed. (29 refs.)

67572 The electronic and magnetic properties of transition metal dichalcogenide intercalation complexes. R.H.Friend (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.593-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The transition metal dichalcogenides possess a layer structure, and are known to accept a wide variety of electron donor species between layers to form intercalation complexes. Three aspects of the magnetic properties of these systems are considered here. First, the changes in band paramagnetism that can be achieved by the increase in the host material conduction band filling on intercalation are considered. Second, carrier localisation, and the formation of local moments, can be induced in systems with strong charge density wave distortions. The system $IT-TaS_2$+hydrazine is discussed. Third, for the intercalation complexes formed with the 3-d transition metals, the local moments present on the 3-d metal ions show a variety of magnetic orderings which are mediated through the conduction electrons in the host layers. Recent polarised neutron experiments are discussed. (27 refs.)

67573 Highly disordered chain in an electric field. V.N.Prigodin, A.N.Samukhin (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Solid State Commun. (USA), vol.46, no.5, p.379-81 (May 1983).
The nonstationary phenomena in one-dimensional disordered hopping systems in an electric field have been studied. The asymptotics of current as $t \rightarrow \infty$ appears to be crucially dependent on the field strength. While in the weak fields the main contribution to the asymptotics of current originates from relaxation processes near the cluster boundaries, in the strong fields the current asymptotics is due to the carrier hopping within long clusters. The obtained results have been generalized to the quasi-one-dimensional case. (7 refs.)

67574 One-dimensional effects in low-temperature conductivity of ultrathin metallic filaments. V.N.Bogomolov, E.V.Kolla, Yu.A.Kumzerov (A.F. Ioffe Phys.-Tech. Inst., Leningrad, USSR).
Solid State Commun. (USA), vol.46, no.5, p.383-4 (May 1983).
The resistance of ultrathin filaments (UF) of Hg (with diameters 20-40 Å) increases as the temperature is lowered as $\Delta R/R \sim T^{-3/2} (T<60K)$ and decreases with the applied electrical field as $\Delta R/R \sim 1/\sqrt{E}$. The magnitude of this effects increases as the diameter of UF is made smaller. Such temperature dependence is interpreted in terms of weak electron localization in one-dimension. The non-linearity of current-voltage characteristics of UF is due to electron-electron interactions in one-dimensional tunnel junctions. (8 refs.)

67575 Electrical transport in electron beam irradiated polyacetylene. K.Yoshino, S.Hayashi, G.Ishii, Y.Inuishi (Faculty of Engng., Osaka Univ., Osaka, Japan).
Solid State Commun. (USA), vol.46, no.5, p.405-8 (May 1983).
Electrical conductivity of non-doped $(CH)_x$ decreases a little and its activation energy increases a little by the electron beam irradiation. The increase of the electrical conductivity of the irradiated $(CH)_x$ by I_2 doping is not so remarkable compared with that of non-irradiated $(CH)_x$. The conductivity of heavily irradiated $(CH)_x$ is very low even after halogen dopings. On the other hand, the effect of the electron beam irradiation on the conductviity of preivously I_2 doped $(CH)_x$ is much less compared with that doped after the electron beam irradiation. These results are explained tentatively by the role of I_2 molecules in the initial stage of radiolysis and the suppression of the cross-linking. (9 refs.)

67576 Charge density wave transport in a novel inorganic chain compound, $(TaSe_4)_2I$. M.Maki, M.Kaiser, A.Zettl, G.Gruner (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Solid State Commun. (USA), vol.46, no.7, p.497-500 (May 1983).
Reports the observation of nonlinear conductivity with a well-defined threshold electric field E_T, and frequency dependent AC conductivity, in a novel linear chain compound, $(TaSe_4)_2I$. The material undergoes a phase transition to a semiconducting phase at T~260K, and nonlinear and frequency dependent transport is observed below this temperature. The authors argue that the material is a new example of collective mode transport provided by a Peierls-Frohlich charge density wave condensate. (7 refs.)

67577 Observation of Shapiro steps in the charge-density-wave state of $NbSe_3$. A.Zettl, G.Gruner (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Solid State Commun. (USA), vol.46, no.7, p.501-4 (May 1983).
Reports the observation of AC-induced Shapiro-like steps in the DC I-V characteristics of $NbSe_3$. Analysis of the steps in terms of a classical model of charge-density-wave (CDW) transport, mathematically equivalent to the Stewart-McCumber model (1968) of Josephson tunnel junctions, indicates a highly coherent sample response, and that coupling phenomena well known in the Josephson literature also occur for CDW transport. (21 refs.)

67578 Disorder effects in the linear chain compound TiS_3. Pei-Ling.Hsieh, C.M.Jackson, G.Gruner (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Solid State Commun. (USA), vol.46, no.7, p.505-7 (May 1983).
Conductivity (σ) and thermoelectric power (S) measurements are reported in the linear chain trichalcogenide TiS_3. The DC conductivity shows a non-exponential temperature dependence below the conductivity maximum, and σ is also strongly frequency dependent. This, together with the anomalous temperature dependence of S is suggestive of disorder effects in this compound. (13 refs.)

67579 The relaxation of electron-phonon system in the halogen bridged quasi-one-dimensional mixed-valence crystal. H.Tanino.
Solid State Phys. (Japan), vol.17, no.12, p.728-34 (Dec. 1982). In Japanese. [received: April 1983]
Wolffram's red salt and related complexes are introduced. The optical spectra are discussed from the standpoint of the barrierless relaxation process characteristic in the one-dimensional system. (28 refs.)

Peierls distortions in two and three dimensions and the structures of AB solids .... See Entry 66901

Band structure properties of one-dimensional donor-acceptor model polymers .... See Entry 67421

Shubnikov-de Haas oscillations in transition-metal pentatelluride .... See Entry 67429

X-ray diffuse scattering study of the organic one-dimensional conductor TMTTF-bromanil .... See Entry 67457

CDW phase transition in $NbSe_3$ and related compounds .... See Entry 67488

Tunneling investigation of charge density wave energy gap in 1T-TaS_2 .... See Entry 67491

Non-linear conductivity of monoclinic TaS_3 .... See Entry 67630

Metal-dielectric type transition in needle crystals of iodine and oxygen doped niobium-sulphur compounds .... See Entry 67704

Transport and structural properties of the silver intercalation complexes of 2H-TaS_2 .... See Entry 67708

Compositional dependence of transformation temperatures in ternary TiNiAl and TiNiFe alloys .... See Entry 68541

Microstructural features of charge density wave (CDW) and martensitic transformations in TiNiFe and TiNiAl alloys .... See Entry 68542

Plastic battery .... See Entry 68863

72.15Q Scattering mechanisms and Kondo effect

(see also 75.20H Local moments in dilute alloys)

The relaxation of electron-phonon system in the halogen bridged quasi-one-dimensional mixed-valence crystal .... See Entry 67579

72.20 CONDUCTIVITY PHENOMENA IN SEMICONDUCTORS AND INSULATORS

(for nonelectronic thermal conduction, see 66.70)

67580 The stability of current filaments in semiconductor systems that have an inhomogeneity. A.M.Nechayev.
Radio Eng. & Electron. Phys. (USA), vol.27, no.5, p.158-63 (May 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.5, p.1020-6 (May 1982). [received: April 1983]
The effect of small spatial inhomogeneities on the localization and stability of current filaments is examined for semiconductor systems with an S-shaped volt-ampere characteristic. Expressions are obtained that interrelate filament stability and the parameters of the inhomogeneities. The possibility for movement of the filament through the sample by varying the parameters of the system and external circuit is shown. (8 refs.)

Measurement of the conductivity of semiconductor disks in the SHF range .... See Entry 64920

72.20D General theory, scattering mechanisms

67581 Strain scattering of electrons in piezoelectric semiconductors. P.A.Fedders (Dept. of Phys., Washington Univ., St. Louis, MO, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1804-7 (April 1983).
Static strains in piezoelectric semiconductors give rise to an electric field or potential which can have an effect on the electrical properties of the material. The authors have calculated the electric potential due to the strain field arising from a random distribution of point defects. This potential contributes a term to the mobility that is proportional to $T^{1/2}$ and a Hall factor of 1.10. Crude estimates of strain strengths indicate that this scattering mechanism may contribute significantly to the mobility of electrically rather pure III-V semiconductors below room temperature when neutral impurity concentrations are greater than 10^{18} cm^{-3}. The mechanism may also constitute a dominant one in the mobility of some III-V alloys at fairly low temperatures. The existence of strain induced electric potentials also provides at least a possible mechanism whereby different donors can have different line shapes as measured in photoconductivity experiments. (10 refs.)

67582 Electron structure and electrical conductivity of the interface in a semiconductor bicrystal. V.A.Gergel', R.A.Suris.
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1243-6 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1925-9 (Nov. 1982). [received: April 1983]
An analysis is made of the low-temperature of the surface electrical conductivity of the interface in a semiconductor bicrystal. The interface is approximated by a plane with a parallel distribution of edge dislocations separated by a distance which is governed by the angle of rotation between the components of the bicrystal. The self-consistent approximation (Thomas-Fermi method) is used to find the distribution of mobile holes in the vicinity of a single-edge dislocation. The characteristic radius of a hole 'cloud' is found to be $R_0=(a_0^3a)^{1/4}$, where a_0 is the Bohr radius of a hole and a^{-1} is the linear density of the charge in a dislocation core. It is shown that in the case when the distance between the individual dislocations d is greater than $2R_0$, conducting hole regions surrounding individual dislocations are separated from one another by energy barriers. The temperature dependence of the electrical conductivity of the interface in a bicrystal is then of activated nature. The dependence of the activation energy of conduction on the parameters of a bicrystal is determined. In the opposite case of $d<2R_0$ the conducting regions around individual dislocations merge and the temperature dependence of the electrical conductivity is of the metallic type. (7 refs.)

67583 Relaxation of fast electrons in semiconductors at coupled plasmon-phonon oscillations. S.E.Kumekov, V.I.Perel' (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1291-4 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2001-6 (Nov. 1982). [received: April 1983]
Scattering of fast electrons is considered for energies much greater than both the phonon energy and the kinetic energy of plasma particles in a semiconductor. The total energy losses are then governed by the interaction with both optical phonons and the plasma, i.e. essentially with coupled plasmon-phonon oscillations. The probability that a fast electron escapes from a state with a given quasimomentum as a result of the interaction with these oscillations is calculated as a function of the plasma density. (12 refs.)

67584 Conduction in two-dimensional electron systems having a one-dimensional superlattice. S.V.Kryuchkov, N.P.Mikheev (A.S. Serafimovich State Pedagogical Inst., Volgograd, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1318-19 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2043-4 (Nov. 1982). [received: April 1983]
The authors present a theoretical study of conduction in two-dimensional electron systems having a one-dimensional superlattice in a strong electric field. To solve this problem, they use the theory of electrical conduction in strong electric fields, taking into account the finite width of the conduction band. (8 refs.)

67585 Carrier drag by phonons in semiconductors having an arbitrary isotropic band. B.M.Askerov (S.M. Kirov State Univ., Baku, Azerbaidzhan SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1346-7 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2083-6 (Nov. 1982). [received: April 1983]
Carrier drag by phonons is treated in a general case, where the motion of carriers in a semiconductor is assumed to be described by an arbitrary isotropic dispersion relation and their degree of degeneracy is arbitrary; the external magnetic field can have any nonquantizing value. It is found that the nonparabolocity of the band and the degree of the degeneracy play an important part in the drag effect, and the former may even be decisive. It is shown that a measurement of the drag thermoelectric power gives immediately the phonon drag force on the carriers. (7 refs.)

High energy diffusion equation for polar semiconductors .... See Entry 67621

Threshold scattering of conduction electrons by magnetic impurities in semimagnetic semiconductors subjected to a strong magnetic field .... See Entry 67659

Magnetophonon oscillation of thermoelectric power—anomalous behaviour in p-type-to-intrinsic transition region of InSb .... See Entry 67666

Surface recombination waves in semiconductors .... See Entry 67745

72.20F Low-field transport and mobility; piezoresistance

67586 On the origin of free carriers in high-conducting n-GaN. W.Seifert, R.Franzheld, E.Butter, H.Sobotta, V.Riede (Sektionen Chem. und Phys., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.383-90 (1983).
Growth experiments with GaN in the system $Ga/HCl/NH_3/He$ at different growth temperatures show that the assumption of N-vacancies to be responsible for the high n-conductivity is questionable. The dependence of carrier concentration on growth temperature as well as the decrease in carrier concentration with additionally purified NH_3 is used indicate that donor impurities are incorporated. The most probable impurity is oxygen, substitutionally incorporated onto N-sites. The observed growth rate dependence of carrier concentration can well be explained by a kinetically controlled incorporation process. (24 refs.)

67587 Influence of intrinsic defects on the electrical properties of $A^IB^{III}C_2^{VI}$ compounds. H.Neumann (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.483-90 (1983).
The electrical parameters of undoped melt grown $A^IB^{III}C_2^{VI}$ crystals are compared with predictions which can be made considering the deviations from stoichiometry due to the incongruent evaporation of these compounds. It is shown that the electrical properties of all $A^IB^{III}C_2^{VI}$ compounds can be interpreted in a consistent manner if the electrical activity (donor or acceptor) of the intrinsic defects is considered within the covalent bonding model. (45 refs.)

67588 The effect of γ-irradiation on amorphous silicon field effect transistors. I.D.French, A.J.Snell, P.G.LeComber (Carnegie Lab. of Phys., Univ. of Dundee, Dundee, Scotland), J.H.Stephen.
Appl. Phys. A (Germany), vol.A31, no.1, p.19-22 (May 1983).
Deals with the effect of γ-radiation from a Co^{60} source on the electronic properties of amorphous silicon field effect transistors. These thin film devices, deposited by the glow discharge technique, are being developed for addressable liquid crystal displays, logic circuits and other applications. 1 Mrad (Si) and 5 Mrad (Si) doses were used and the transistors were held at gate voltages between −8 V and +8 V during irradiation. Measurements on irradiated specimens showed shifts in threshold voltage of less than 3 V and a change in transconductance below 10%, both of which could be removed by annealing above 130°C. These results are compared with presently available 'radiation hardened' crystalline silicon device structures and it is concluded that in spite of the thicker gate insulation layer (0.3 μm of silicon nitride) of the amorphous devices, the latter are remarkably radiation tolerant, with little degradation in performance. Measurements on irradiated a-Si films deposited on glass show pronounced conductivity changes, not observed in the transistors. It is suggested that these effects arise at the Si/glass interface, and are prevented by the presence of the silicon nitride film in the devices. (10 refs.)

67589 Mobility of charge carriers in α-HgI$_2$ crystals. M.M.Gospodinov, A.I.Miteva (Inst. of Nuclear Phys., Bulgarian Acad. of Sci., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.35, no.12, p.1655-6 (1982).
In spite of the considerable success obtained by using α-HgI$_2$ crystals as nuclear detectors operating at room temperature, there still exist difficulties due to the trapping of carriers. The relatively low drift mobilities and trapping times limit the performances of high energy γ-ray spectrometers. The mobility of charge carriers in α-HgI$_2$ has been investigated. The authors determined the room temperature mobility of charge carriers on crystals grown by the 'temperature oscillation method' where the source temperature was oscillated. (33 refs.)

67590 Resistivity, Hall mobility and leakage current variations in undoped semi-insulating GaAs crystal grown by LEC method. T.Matsumura, H.Emori, K.Terashima, T.Fukuda (Optoelectronics Joint Res. Lab., Kawasaki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L154-6 (March 1983).
The resistivity and Hall mobility (measured at 400K) variations across undoped semi-insulating GaAs wafers obtained from the upper part of the LEC grown ingot have been measured and are compared with the dislocation density variation. It has been found that the resistivity is almost inversely proportional to the dislocation density and Hall mobility is proportional to the logarithm of the dislocation density. The authors have further measured the leakage current variation in comparison with the resistivity and dislocation density variation. Both the leakage current and resistivity show an M shaped variation across the wafers which have a W shaped dislocation density variation.

67591 Peculiarities of the residual conductivity in photoconductor-dielectric materials based on cadmium sulfide. E.F.Afon'ko, A.S.Tonkoshkur, A.Ya.Yakunin (Dnepropetrovsk State Univ., Dnepropetrovsk, USSR).
Inorg. Mater. (USA), vol.18, no.5, p.732-3 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.872-3 (May 1982). [received: Feb. 1983]
Residual conductivity of semiconductor materials based on CdS has been linked with the nonhomogeneity of their structure and the existence of potential barriers. A study is made of the indicated interrelationship in the case of nonhomogeneous substances with a technologically regulated structure, particularly two-component photoconductor-dielectric materials that can be represented by a model of a system of semiconductor particles in a dielectric medium. The results of a study of the temperature dependence of the dark currents [I(T)] for photoconductor-dielectric materials of this type are presented. The I(T) dependences in the case of heating and subsequent cooling do not coincide, and in the low-temperature region the I value recorded during cooling considerably exceeds the corresponding I values in the case of heating. This difference becomes greater as the applied electric field is increased. (3 refs.)

67592 Magnetochemical study of barium titanate doped with tantalum pentoxide. M.A.Kvantov, Yu.P.Kostikov.
Inorg. Mater. (USA), vol.18, no.6, p.830-2 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.988-90 (June 1982). [received: Feb. 1983]
It has been experimentally verified that solid solutions are formed in semiconducting barium titantate doped with Ta_2O_5. At concentrations of Ta_2O_5 exceeding 0.05-0.1 mole %, conducting grains of $BaTiO_3$ are covered with insulating layers which substantially influence the electrical conductivity. (9 refs.)

67593 Electron mobilities and electron-ion recombination rate constants in solid, liquid, and gaseous methane. Y.Nakamura, K.Shinsaka, Y.Hatano (Dept. of Chem., Tokyo Inst. of Technol., Tokyo, Japan).
J. Chem. Phys. (USA), vol.78, no.9, p.5820-4 (1 May 1983).
Electron mobilities and electron-ion recombination rate constants have been measured in methane by an X-ray pulse conductivity technique over the density region from 2×10^{20} to 1.9×10^{22} molecules/cm^3 including the critical region and the liquid-solid phase change. The observed electron mobility abruptly increases on the transition from liquid to solid, which is probably due to the change of isothermal compressibility of methane on the phase change. The observed electron-ion recombination rate constant is in good agreement with the value calculated by the reduced Debye equation in solid methane but not in liquid and gaseous methane. The deviation from the reduced Debye equation is larger in the gas phase than in the liquid phase, which is probably caused by the difference in the efficiency of excess-energy loss of electrons within the reaction radius of electron-ion recombination. (23 refs.)

67594 Temperature dependence of AC conductivity in glassy $As_{40}Se_{60}Ag_x$. K.Hirata (Graduate School of Electronic Sci. & Technol., Shizuoka Univ., Hamamatsu, Japan), M.Kitao, S.Yamada.
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1317-23 (April 1983).
AC conductivity of glassy $As_{40}Se_{60}Ag_x$ ($x=0\sim0.5$) was measured at temperatures from 77K to 400K in the frequency range from 30 Hz to 5 MHz. Below 1 MHz, the AC conductivity $\sigma_{ac}(\omega)$ is proportional to ω^s. In an As_2Se_3 sample ($x=0$), the value of $\sigma_{ac}(\omega)$ depends linearly on the frequency and is nearly independent of temperature. In the samples containing silver, $\sigma_{ac}(\omega)$ increases with silver content, especially at high temperatures and low frequencies. The value of the exponent s is about 1.0 at 80K, and decreases to 0.5 at 350K. Temperature dependence of $\sigma_{ac}(\omega)$ and s in both samples is reasonably interpreted by the correlated barrier hopping model. Numerical calculations in the cases of bipolarons and single-polarons agree well with the experimental results on the samples without silver and those containing silver, respectively. (15 refs.)

67595 Electrical conductivity of Ni-Zn ferrites. R.Satyanarayana, S.Ramana Murthy, T.Seshagiri Rao (Dept. of Phys., Coll. of Sci., Osmania Univ., Hyderabad, India), S.M.D.Rao.
J. Less-Common Met. (Switzerland), vol.90, no.2, p.243-50 (April 1983).
The electrical conductivity σ of polycrystalline Ni-Zn ferrites of various compositions was investigated from room temperature to the neighbourhood of the Curie temperature. The electrical conduction in these ferrites is explained on the basis of the hopping mechanism. Plots of $\log(\sigma T)$ versus $10^3/T$ are almost linear and show a transition near the Curie temperature. The activation energy in the ferrimagnetic region is in general less than that in the paramagnetic region. (20 refs.)

67596 Electrical resistivity of uranium monosulphide. R.Troc, L.Krawczyk (Inst. for Low Temperature & Structure Res., Polish Acad. of Sci., Wroclaw, Poland).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L45-8 (April 1983).
The electrical properties of uranium monosulphide (US) which is a ferromagnet at temperatures below about 180K have been investigated. The authors report resistivity data for US single crystals measured as a function of temperature. The measurements were made in two directions ([100] and [110]) in order to detct any anisotropy in the resistivity behaviour. (12 refs.)

67597 Electrical properties of ion-implanted poly(*p*-phenylene sulfide). H.Mazurek, D.R.Day, E.W.Maby, J.S.Abel, S.D.Senturia, M.S.Dresselhaus, G.Dresselhaus (MIT, Cambridge, MA, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.537-51 (April 1983).
Ion implantation of impurities into thin films of poly(*p*-phenylene sulfide) (PPS) is found to increase the conductivity of the material by up to 12 orders of magnitude. The increase is stable under exposure to ambient conditions, in contrast to the instability of the conductivity increases in PPS produced by chemical doping with AsF_5. PPS films 0.1-0.2 μm thick are spin cast from solution onto interdigitated electrodes patterned on an oxidised silicon substrate. The room-temperature interelectrode resistance is measured as a function of implantation fluence. An estimate of film conductivity is obtained from this resistance with a simple model for the electrode and film geometry. A first experiment yielded similar conductivity increases for implantation of either arsenic or krypton. At a fluence of 1×10^{16} cm^{-2}, which corresponds to an average impurity concentration of 2.5×10^{21} cm^{-3}, the conductivity reaches an apparantly saturated value of 1.5×10^{-5} $(\Omega\ \mathrm{cm})^{-1}$. Infrared spectra of the films before and after implantation suggest that crosslinking may be present in the implanted films, and Auger studies show stoichiometric changes throughout the implanted layer. (30 refs.)

67598 Correlation between electrical and vibrational properties of chlorinated and hydrogenated amorphous silicon prepared by glow discharge. S.Al Dallal, J.Chevallier, S.Kalem, J.Bourneix (Lab. de Phys. des Solides, CNRS, Meudon-Bellevue, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.323-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Electrical conductivity and infrared transmission measurements have been carried out on chlorinated and hydrogenated amorphous silicon films prepared by glow discharge. Upon increasing the plasma power, the authors observed a change of transport mechanism, accompanied by an evolution of hydrogen and chlorine related bands. From this correlation between the transport and the infrared data they suggest that the evolution of $SiCl_2$ species with the plasma power is mainly responsible for the change in bandgap states density and consequently in the transport mechanism. (14 refs.)

67599 Electrical properties of glasses and vitroceramics containing MnO_2. G.Fernandez-Arroyo, C.Moure Jimenez (Inst. de Ceramica y Vidrio, CSIC Arganda del Rey, Madrid, Spain).
J. Phys. Colloq. (France), vol.43, no.C-9, p.419-22 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Compositions of SiO_2-Al_2O_3-Li_2O-MnO_2, SiO_2-ZnO-Li_2O-MnO_2 and SiO_2-MgO-Li_2O-MnO_2 systems have been prepared. The melting temperatures were obtained by high temperature microscopy. Two different melting processes were made; one, in a platinum crucible with induction heating; another in a refractory crucible and gas-fired furnace. Their influence on the properties of the materials obtained is discussed. The transition and crystallization temperatures were determined by DTA and electric conductivity measurements. The crystalline phases were identified by X-ray diffraction. The charge carrier nature and conduction as temperature curves in glass and glass ceramics of every system have been established. A high-field nonohmic behaviour of glass ceramics at several temperatures has been observed. (3 refs.)

67600 Studies on (dark) electric conductance of PVC films. J.Bigalewicz (Inst. Matematyki i Fizyki, Polytech. Rzeszowska, Rezeszow, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.27, no.2, p.74-7 (Feb. 1982). In Polish. [received: March 1983]
The dark volume conductance of films of amorphous PVC prepared by various methods has been investigated. The dependence of the current density of films on temperature in the range of 20-117°C has been studied. The influence of the thickness of PVC film prepared by the method of bulk polymerization on the electric conductance has also been studied. A preliminary estimation of the mobility of charge carriers and of their density at temperatures below and above the glass transition point has been given. (23 refs.)

67601 Low frequency hopping conduction in n-type InSb in the magnetic freeze-out region below 1K. R.Mansfield, C.Zhonggan, P.Fozooni (Bedford Coll., London Univ., London, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.232-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The complex conductivity of n-type InSb has been measured at low frequencies in magnetic field up to 70 kG and for temperatures 1 to 0.04K on two samples. In the magnetic freeze-out region, where conduction is by correlated hopping, $\mathrm{Re}(\sigma)$ is many orders of magnitude greater than σ_{DC} and depends on frequency (ω) as ω^s. Application of the Kramers-Kronig relation to $\mathrm{Im}(\sigma)$ yields the same value of s. Below 0.1K, $s\simeq1$; $\mathrm{Re}(\sigma)$ becomes independent of the temperature, weakly dependent on B and the more heavily doped sample has the lower $\mathrm{Re}(\sigma)$ although the difference in $\mathrm{Re}(\sigma)$ is relatively small considering the differences in doping level and σ_{DC} of the two samples. (10 refs.)

67602 New results in transport phenomena in uncompensated n-type InSb with extremely low carrier density. A.Kadri, R.L.Aulombard, C.Bousquet, A.Raymond, J.L.Robert (CNRS, Univ. Sci. et Techniques du Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.235-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors report new experimental results of low temperature (4.2K-95K) transport phenomena in uncompensated n-type InSb sample, where very low free carrier concentrations are obtained using the properties of a metastable impurity state. By varying free electron density in the same sample, from 10^{11} cm^{-3} to 10^{14} cm^{-3} the metal-non metal transition is observed. The evidence of an activation energy of the hydrogenic level corresponding to the effective Rydberg is given. Above 40K the role of a donor-like impurity level is shown. (7 refs.)

67603 The activation energy of impurity conduction with sequentially correlated hopping. M.Ortuno, M.Pollak (Dept. of Phys., Univ. of California, Riverside, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.254-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors study the effects of correlations in successive jumps on the reduction of the activation energy ϵ_3 in impurity conduction at low concentrations. A mean field theory and a dielectric approach are used. They find that ϵ_3 is reduced by about 30% with respect to calculations without sequentially correlated hopping. The new value is in better agreement with the experimental results and with Monte Carlo calculations by Nguyen, et al. (1979). (10 refs.)

67604 Delocalization of H^--like impurity states and formation of band type impurity conductivity in semiconductors. E.M.Gershenson, A.P.Mel'nikov (Lenin State Pedagogical Inst., Moscow, USSR), V.N.Murzin, R.I.Rabinovich, I.E.Trofimov.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.257-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The data obtained represent the experimental evidence that the band impurity conductivity formation is determined by the delocalization of H^--impurity states in doped semiconductors. The paper reports the far IR photoconductivity and the magnetoresistance results, measured in doped and weakly compensated Si at different temperatures, electrical fields and impurity photoionization intensities. (9 refs.)

67605 Electrical and optical properties of black phosphorus single crystals. S.Narita (Dept. of Material Phys., Osaka Univ., Osaka, Japan), Y.Akahama, Y.Tsukiyama, K.Muro, S.Mori, S.Endo, M.Taniguchi, M.Seki, S.Suga, A.Mikuni, H.Kanzaki.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.422-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Large single crystals of black phosphorus have been prepared by a large volume-high pressure technique at high temperature. Using the crystals, the authors have measured temperature dependences of the electrical conductivity and the Hall coefficient, the FIR cyclotron resonance absorption and the reflectance for synchrotron radiation. All samples obtained are p-type and the Hall mobility reaches 5×10^4 cm^2/v.sec around 20K. The anisotropies of the effective mass, the Hall mobility and the SOR reflectance along the three crystal directions, a, b, and c, have been observed. (8 refs.)

67606 Hopping conduction of the bound magnetic polarons in n-CdMnSe. T.Dietl, J.Antoszewski, L.Swierkowski (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.491-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Low temperature measurements of resistivity as a function of magnetic field and for various net donor concentrations in $Cd_{0.95}Mn_{0.05}Se$ are reported. At low concentration results are in agreement with a model of the hopping of bound magnetic polarons if the thermodynamical fluctuations of magnetization are taken into account. At higher concentrations the magnetoresistance is larger than that expected from the theory. This suggests an onset of the correlated hopping. (7 refs.)

67607 Non-Ohmic conduction and weak localization in 1T-TaS$_2$. S.Uchida, S.Tanaka (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.673-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The electron localization in 1T-TaS$_2$ is studied by means of the non-Ohmic conduction which is observable below liquid N_2 temperature. It is found that an electric field has the effect of raising the electron temperature. The non-Ohmic conduction due to the electron heating mechanism is highly suggestive of the existence of weakly localized states in 1T-TaS$_2$. (11 refs.)

67608 Electronic transport in metallic Ge:Sb at very low temperature. Y.Ootuka, S.Kobayashi, W.Sasaki (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.700-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The electronic conductivity of metallic Ge:Sb below 1K is analyzed on the basis of recent theories of disordered metals. The temperature and magnetic field variation of conductivity is consistent with the theories. For the absolute value, the theory of localization overestimates, while that of interaction underestimates the effects. (8 refs.)

67609 Influence of impurities on the electrical properties of $Se_{65}Te_{35}$ glasses. P.Nagels, M.Ali, M.Rotti (Materials Sci. Dept., CEN, Mol, Belgium).

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.989-91 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

A study of the influence of iodine in the electrical transport properties of $Se_{65}Te_{35}$ glasses is presented. The role played by iodine addition on some structure-sensitive properties as glass transition, crystallization and melting is also investigated by DSC measurements. The addition of iodine leads to an increase of the electrical conductivity and a decrease in the thermopower. In contrast to earlier work, in which n-type conduction in chlorine-doped Se was reported, the authors observe a positive thermopower in the pure and doped glasses. The results are discussed taking into account the possible interactions between the halogen and the chalcogen atoms. (3 refs.)

67610 Amorphous barium vanadates doped with transition metals. L.D.Bogomolova, S.N.Spasibkina (Inst. of Nuclear Phys., Moscow State Univ., Moscow, USSR).

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.998-1000 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The EPR and Mossbauer spectra, static magnetic susceptibility and DC conductivity were measured in amorphous BaV_4O_{11} doped with Cr, Mn, Fe, Co, Ni and Cu impurities. The results are discussed in terms of the formation of associates between vanadium and the impurities. (5 refs.)

67611 The electrical conductivity of amorphous antimony and its dependence on film thickness. A.J.Mackintosh, R.T.Phillips, A.D.Yoffe (Cavendish Lab., Univ. of Cambridge, Cambridge, England).

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1001-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Thin films of amorphous antimony have been prepared by thermal evaporation in high vacuum ($<10^{-7}$ mbar) onto sapphire substrates held at 77K. The electrical resistance of the films has been measured between 10K and 77K and shows $T^{-1/3}$ behaviour for 2-D ($<$200 Å) films, and $T^{-1/4}$ behaviour for 3-D films. Values of the localisation length (17 Å) and density of states at the Fermi level (1×10^{18} states/eV/cm^3) have been obtained from the thickness-dependence of the resistivity. These are found to be in good agreement with those obtained from high-field measurements on the same 3-D films (14-24 Å and 2.0-0.4$\times10^{18}$ states/eV/cm^3). (13 refs.)

67612 The DC conductivity of chalcogenide films due to the correlated barrier hopping mechanism. M.H.A.Pramanik, P.N.Butcher, I.D.Cox (Dept. of Phys., Univ. of Warwick, Coventry, England).

Philos. Mag. B (GB), vol.47, no.4, p.437-43 (April 1983).

Within the pair approximation, the correlated barrier hopping (CBH) mechanism apparently correlates the observed trends in the AC conductivities of chalcogenide films. Invoking an extended pair approximation, it is found that this mechanism is consistent in the case of wide band-gap materials in that it gives rise to an insignificant contribution to the observed DC conductivity which may then be correctly accounted for by invoking other processes. In the case of small band gap materials, however, this mechanism yields DC conductivities orders of magnitude larger than are observed. (15 refs.)

67613 Pressure and composition dependence of the electrical conductivity of iron-rich synthetic olivines to 200 kbar. A.Lacam (Inst. de Phys. du Globe, Univ. Paris, Paris, France).

Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.127-32 (1983).

The objectives of this study of olivines are to calibrate the variation of electrical conductivity with pressure up to 200 kbar in a diamond-anvil cell, and to determine how this is influenced by chemical composition. Experimentally, the author has found that the variation of the electrical conductivity of three synthetic olivines containing 50, 75 and 100 mole percent of fayalite, is an exponential function of pressure *P*, closely represented at room temperature by: $\sigma_{xP}=\sigma_x.\exp.(B_x.P)$ where x is the iron content of the olivine, σ_x the extrapolated value of conductivity at normal pressure and B_x the slope of the regression line in semi-logarithmic coordinates. It is thus possible to express the temperature dependence of conductivity through a Boltzmann relationship. On the other hand, σ_{xT} is an exponential function of x and thus, B_x and of course $V_x{}^*$ are linear functions. The experimental procedure is described and the results discussed. (23 refs.)

67614 Small-polaron hopping in magnetic semiconductors. D.Emin (Sandia Nat. Labs., Albuquerque, NM, USA), Nai Li Huang Liu.

Phys. Rev. B (USA), vol.27, no.8, p.4788-98 (15 April 1983).

The theory of small-polaron hopping transport in magnetic semiconductors and insulators is formulated via a many-electron generalization of the one-electron tight-binding approach utilized in standard small-polaron theory. Here the magnetic effects are taken into account from first principles by constructing the electronic wave function from linear combinations of antisymmetrized products of Wannier states involving both the itinerant electron and the valence electrons. This enables the authors to determine the effect of the indistinguishability of an itinerant electron from valence electrons on the transfer of an electron between two magnetic ions. To treat hopping within a magnetic lattice the magnetic environment surrounding the two sites directly involved in a hop is approximated by an effective internal magnetic field. It is found that in the paramagnetic and ferromagnetic regimes the magnetic nature of the solid only reduces the small-polaron mobility by a weakly temperatures-dependent factor of the order of unity. However, below the Neel temperature in an antiferromagnet it is found that electronic transitions only occur between nondegenerate states. This results in an additional activated factor in the small-polaron mobility. (18 refs.)

67615 Pressure effect on the resistance of InS. K.Takarabe, K.Wakamura, E.Ito (Dept. of Natural Sci., Okayama Univ. of Sci., Okayama, Japan).

Solid State Commun. (USA), vol.46, no.2, p.215-16 (April 1983).

The effect of pressure on the resistance of InS was studied to pressure higher than to 150 kbar for single crystal and to *ca.* 300 kbar for powdered samples. The resistance exhibits a sharp maximum at 47 kbar, which is explainable by the change of band structure due to pressure increase. Under higher pressure, the resistance decreased gradually with increasing pressure. A marked change in slope, however, was observed at 108 kbar, suggesting a phase transition possibly to a metallic phase. (9 refs.)

67616 Activated hopping mobility of carriers in magnetic semiconductors. E.L.Nagaev, A.I.Podel'shchikov.

Sov. Phys.-Solid State (USA), vol.24, no.10, p.1717-20 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3033-9 (Oct. 1982). [received: April 1983]

The state of a donor electron in a polarizable magnetic semiconductor was studied, together with the kinetics of hopping conduction via an impurity. Such a state combines the features of a localized Pekar polaron and a localized ferron. Because of the competition of various interactions, the electron radius in a paramagnetic crystal has a minimum as a function of temperature. In a partly compensated semiconductor, electron jumps from one donor atom to another become possible. As with small polarons, the movement of the lattice polarization together with the electron gives rise to a mobility activation energy. The mobility is very greatly reduced by the ferron effects, in comparison with a nonmagnetic semiconductor. Since these effects in paramagnetic and antiferromagnetic semiconductors decrease with increasing temperature, the effective activation energy of the mobility decreases also. (16 refs.)

67617 Aysmmetry of the electrical condictivity in pyroelectrics. B.I.Sturman (Inst. of Automation & Electrometry, Acad. of Sci., Novosibirsk, USSR).

Sov. Phys.-Solid State (USA), vol.24, no.10, p.1742-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3079-84 (Oct. 1982). [received: April 1983]

It is shown that asymmetry of the periodic potential in pyroelectric crystals and also the presence of macroscopic asymmetric barriers to the charge carriers lead to a sharp asymmetry of the electrical conductivity, $j(E)\neq-j(-E)$. (10 refs.)

67618 Surface mobilities in laser-processed polysilicon films. R.C.Frye, K.K.Ng (Bell Labs., Murray Hill, NJ, USA).

Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.275-86

Surface mobilities in laser-processed polysilicon films were measured using silicon-gate n-channel thin-film transistors of varying dimensions. The apparent surface mobility inferred from transconductance measurements was found to be a decreasing function of channel length. For very short ($\sim$0.3 μm) channels, this mobility approaches the surface mobility of identical devices fabricated on bulk silicon. Furthermore, the temperature dependence of the surface mobilities in polycrystalline and bulk films was found to be identical. A novel EBIC technique was employed to examine the surface potential of transistors in operation. These measurements indicate a high degree of spatial nonuniformity in the inversion layer of polycrystalline films arising from the grain boundary region. A simple model of the transistors is presented which explains the geometry dependent surface mobility and its temperature dependence. (30 refs.)

67619 Grain boundaries in crystallized silicon thin films. N.M.Johnson, D.K.Biegelsen, M.D.Moyer (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).

Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.287-96

The presence of residual grain boundaries in laser-crystallized thin films of silicon necessitates an understanding of their properties and effects on device operation. In CW laser crystallized silicon islands, lateral p-n junction diodes have been used to evaluate the following: (1) enhanced arsenic diffusion along grain boundaries, (2) current-voltage characteristics, and (3) effects of hydrogenation on diode operation. To study the process of hydrogen passivation, deuterium has been used as a readily identifiable isotope which duplicates hydrogen chemistry. From secondary-ion mass spectrometry, diffusion of deuterium in single-crystal and polycrystalline silicon at low temperatures (e.g. 350°C) clearly demonstrates that grain-boundary diffusion dominates bulk diffusion. (15 refs.)

Doping of amorphous silicon by implantation of manganese ions .... See Entry 66849

Investigation of the structure of solid solutions of elements of the IV. Group (Si, Ge) in gallium antimonide .... See Entry 66940

The influence of Bi on the lattice constant and the carrier concentration of PbTe .... See Entry 66942

Effective *p*-type doping of diamond by boron ion implantation .... See Entry 67026

Distribution of indium ions in indium substituted Mn-Zn ferrites .... See Entry 67028

Inner differentiation of growth sectors induced by the interaction between dislocations and sector boundaries in KH_2PO_4 crystals .... See Entry 67030

Low-temperature structural transition in strontium tellurite ..... See Entry 67201

Electronic criteria for distinction between weak and strong ionosorption .... See Entry 67346

Transparent conductive films of tin oxide-preparation and properties .... See Entry 67407

Electronic properties of sulfur containing conjugated polymers .... See Entry 67432

Spin interaction enhanced anisotropy of the band overlap in $Hg_{.97}Mn_{.03}Te$ .... See Entry 67444

Impurity states in n-type $Hg_{1-x}Cd_xTe$ in high magnetic field and under hydrostatic pressure .... See Entry 67526

The exchange contribution to the binding energy of acceptors in CdMnTe .... See Entry 67527

Impurities in semimetals .... See Entry 67533

Theory of order-disorder transitions for inhomogeneous mixed-valence systems .... See Entry 67546

Strain scattering of electrons in piezoelectric semiconductors . See Entry 67581

Polaron nature of charge carriers in silver azide .... See Entry 67635

Localized magnetic moments in $Bi_{1-x}Sb_x$ semiconductor alloys .... See Entry 67661

Nonlinear *I-V* behaviour and thermo-EMF in amorphous semiconducting selenium-tellurium alloys .... See Entry 67663

The preparation of fine grained thermoelectric alloys by vacuum hot pressing .... See Entry 67668

Effect of composition on the structure and electrical properties of As-Se-Cu glasses .... See Entry 67705

Effect of Al electrodes on DC and AC current-voltage characteristics of chalcogenide glass films .... See Entry 67706

Model of a low-resistivity state formed as a result of nanosecond electric switching in amorphous semiconductor films .... See Entry 67712

Plasmons, intersubband resonance and localization in inversion layers with periodically structured gate electrodes .... See Entry 67717

Electron mobility and Landau level width modulation-doped GaAs-$Al_xGa_{1-x}As$ heterojunctions .... See Entry 67763

Non-metallic transport in silicon inversion layers and the Hall effect .... See Entry 67790

Thermomagnetic coefficients of inversion layer in high magnetic field .... See Entry 67791

Transition from 1-dimensional to 2-dimensional hopping conductivity in silicon accumulation layers .... See Entry 67793

Nonmetallic localization and interaction in one-dimensional (0.1 μm) Si MOSFETs .... See Entry 67794

Physical and electrical properties of polycrystalline silicon thin films .... See Entry 67825

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, X=O, S, Se .... See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te .... See Entry 67904

Critical effects in ferromagnetic semiconductors .... See Entry 67939

Dielectric losses in zinc oxide ceramics .... See Entry 68121

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

Temperature dependence of residual light transmission in lithium niobate single crystals .... See Entry 68149

Luminescence, transient transport and photoconductivity in chalcogenide glasses .... See Entry 68315

Synthesis and physical properties of $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$ ... See Entry 68434

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition .... See Entry 68448

Deposition and properties of zinc phosphide films .... See Entry 68454

72.20H High-field and nonlinear effects

67620 Measurement of high electron drift velocity in a submicron, heavily doped graded gap $Al_xGa_{1-x}As$ layer. B.F.Levine, C.G.Bethea, W.T.Tsang, F.Capasso, K.K.Thornber, R.C.Fulton, D.A.Kleinman (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.769-71 (1 May 1983).
The authors have directly determined a high velocity ($\nu=1.8\times10^7$ cm/s) for electrons in a submicron (0.42 μm), strongly graded (quasifield $F=8.8$ keV/cm) highly doped ($p=4\times10^{18}$ cm^{-3}) $Al_xGa_{1-x}As$ layer. A transit time of only 1.7 ps was measured (an order of magnitude shorter than that for $F=1.2$ kV/cm). Such a structure would be ideal for the low resistance base of a high-speed *n-p-n* transistor. (23 refs.)

67621 High energy diffusion equation for polar semiconductors. J.P.Leburton, K.Hess (Dept. of Electrical Engng., Univ. of Illinois, Urbana, IL, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.211-13 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors present a novel method to explicitly solve the Boltzmann equation for highly energetic electrons interacting with polar optical phonons and scattering mainly in forward direction. The approach reduces the collision integral of the Boltzmann equation into a differential operator which is much easier to manipulate than the integral form and does not require a relaxation time approximation. The spatial diffusion of highly energetic electrons is calculated and discussed in context with high speed velocity transients ('ballistic transport'). Explicit results compare favorably with sophisticated Monte Carlo simulations and are well suited to treat complex transport problems in submicron III-V devices. As an example they calculate the current voltage characteristic of a 'camel-back diode'. (8 refs.)

67622 Direct evidence for screening of carrier-acoustic phonon interaction at low to medium carrier densities in GaAs. H.Munzel (Inst. fur Halbleitertech., RWTH Aachen, Aachen, Germany), D.Bimberg, A.Steckenborn.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.214-16 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Direct evidence for screening of the electron (and hole)-piezoelectric acoustic phonon interaction in GaAs even at low to medium carrier densities (10^{13}-10^{16} cm^{-3}) is reported and indications for a partial screening of the carrier-deformation potential interaction are discussed. These conclusions are based on detailed experimental determinations of the dependence of energy dissipation rates of hot carriers on carrier and lattice temperature under steady state conditions and free decay of a hot gas. Diffusion loss mechanisms govern the energy transfer of a hot carrier plasma to the lattice in steady state and in the transient case. Hole-deformation potential scattering and electron-deformation potential scattering, respectively, are the dominant processes in contrast to previous belief. The dissipation rate is more than one order of magnitude larger under continuous excitation. (9 refs.)

67623 Field dependent scattering and hot electron kinetics. D.C.Herbert, S.J.Till (Royal Signals & Radar Establ., Malvern, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.217-19 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A new hot electron kinetic equation based on the use of real space Airy functions is discussed. The electron-phonon scattering vertex in the Airy function basis is localised in real space, and when the resonant width extends to the band tail region, a field dependent suppression of scattering at low kinetic energy results. The kinetic equation is only equivalent to the Boltzmann equation for homogeneous situations, when the field dependence of the scattering is neglected. A variational technique for solving the kinetic equation has been developed which allows very rapid numerical evaluation and consequently should assist in studying more complex phenomena in very small devices, or devices operating at very high electric fields. (7 refs.)

67624 Transport phenomena of hot holes anomalously distributed in a warped energy band of silicon. K.Kajita (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.223-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Hot hole effects of low density heavy holes in silicon are investigated. Anomalous transport phenomena such as negative Hall effects are interpreted in terms of the 'streaming' and the 'accumulation' of heavy holes in the warped energy band. (6 refs.)

67625 An approach to non-stationary hot electron transport by the Langevin equation method. N.Pottier (Ecole Normale Superieure, CNRS, Univ. Paris VII, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.241-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A new method of treating the non-stationary high-field electron transport in semiconductors is presented: the two dynamically coupled systems of electrons and phonons in the presence of a high $\vec{E}$-field are studied in a Heisenberg picture, and a Langevin equation for the relevant electron operators is derived microscopically for the first time in this case. The two-time correlation function of the Langevin force is calculated and a non-stationary electric-field-dependent velocity diffusion coefficient is defined. This coefficient can be related to the collision term of the master equation for the electron density matrix, which constitutes a generalization of the fluctuation-dissipation theorem to this non-stationary and non-linear situation. (9 refs.)

67626 Theory of relaxation of hot electrons and oscillatory photoconductivity in polar semiconductors. R.Evrard, Ph.Lambin, J.Schmit (Inst. de Phys., Univ. de Liege, Liege, Belgium).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.247-50 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The Boltzmann equation is solved for the relaxation of out-of-equilibrium electrons due to optical and acoustical phonons. The first stage of the relaxation, governed by the optical phonons, is quite fast and leads to a non Maxwellian distribution. The acoustical phonons are responsible for the second stage of the relaxation, much slower and leading to a Maxwellian distribution. Comparison is made with the experimental results for GaAs. The stationary situation encountered in the study of the oscillatory photoconductivity and photoluminescence is also studied. It is shown that the electron population has an oscillatory behaviour versus the energy at which they are photo-injected. (8 refs.)

67627 Impact ionization probability and photo quantum efficiency in InSb. J.T.Devreese (Eindhoven Univ. of Technol, Eindhoven, Netherlands), R.G.van Welzenis, R.P.Evrard.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.435-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A method to calculate the photo-quantum efficiency in polar semiconductors by solving the Boltzmann equation is used to estimate the probability per unit time for impact ionization in InSb at 90K. Several simplifying assumptions (e.g. regarding the bandstructure of InSb) are made but they do not limit the generality of the method. (5 refs.)

67628 Spin-hot electrons in photoexcited p-type InSb. K.Fujii, T.Ohyama, E.Otsuka (Dept. of Phys., Osaka Univ., Osaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.502-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Electron cyclotron resonance has been distinctly observed for the first time in p-type InSb by pulsed intrinsic photoexcitation. Investigation by means of time resolution leads to the confirmation of an 'optical hot electron' system. Temperature of this system rises up to 60K for strong excitation and its time constant of cooling is as long as several microseconds at the lattice temperature of 4.2K. A crude calculation for spin flipping between 0^- and 0^+ Landau subbands is in good agreement with the apparent cooling process, showing the slow energy relaxation to be interpreted in terms of spin relaxation. (9 refs.)

67629 Phase transition and chaos in electrical avalanche breakdown caused by weak photoexcitation at 4.2K in n-GaAs. K.Aoki, K.Miyamae, T.Kobayashi, K.Yamamoto (Dept. of Electrical & Electronic Engng., Kobe Univ., Kobe, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.570-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Periodic oscillations and turbulence in connection with electrical avalanche breakdown have been observed in high-purity n-GaAs at 4.2K, using a pulse voltage of ~4 V/cm and with weak photoexcitation around the band-gap energy. The oscillatory behavior follows the chaotic regime in the fluid flow system, and gives a first example of the onset of chaos which originates in a new type of phase transition in semiconductors. (5 refs.)

67630 Non-linear conductivity of monoclinic TaS_3. K.Hasegawa, A.Maeda, S.Uchida, S.Tanaka (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.599-601 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Strongly non-ohmic conduction is observed in the semiconducting charge-density-wave (CDW) state of monoclinic TaS_3 above a very sharp threshold field. These features could be interpreted in terms of depinning or tunneling of pinned CDW under an applied electric field. Large noise appears with the onset of the non-linear conductivity and fades away as the current through the samples is increased, which because as a decreasing function of frequency. (12 refs.)

67631 Transition rate for impact ionization in the approximation of a parabolic band structure. J.Geist, W.K.Gladden (Radiometric Phys. Div., NRS, Washington, DC, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4833-40 (15 April 1983).
Recently, Alig, Bloom, and Struck (1980) have reported a simple model of ionization scattering in semiconductors and insulators. Their model is based upon the random-k approximation to the transition rate for impact ionization, and upon a generic band structure with only two free parameters to describe all materials. The present paper describes the first step in an attempt to understand in detail why such a simple model works so well. The random-k approximation to the transition rate for impact ionization is tested on a highly symmetric band-structure model for which most of the dimensions of the twelve-dimensional transition-rate integral can be treated analytically. The difference near threshold between the random-k approximation and the rigorous result can be much larger than indicated by Kane's (1976) Monte Carlo integration for the silicon band structure, but this difference seems to be unimportant in practical problems where impact ionization competes with phonon emission. (4 refs.)

67632 Combined breakdown in bismuth-antimony semiconductor alloys. E.V.Bogdanov, V.V.Vladimirov, V.N.Gorshkov (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Solid State Commun. (USA), vol.46, no.2, p.193-6 (April 1983).
S-shaped current-voltage characteristics for $Bi_{1-x}Sb_x$ alloys are studied theoretically and experimentally. The phenomenon is shown to occur due to the combined interband breakdown, the impact ionization being caused both by the external electric field and the Hall field. The latter is governed by the proper magnetic field of the plasma current. The negative differential resistance (NDR) occurs for the range of currents where the impact ionization is growing intensively but the pinch effect is not yet developed to full extent. The phenomenon is enhanced if the impact ionization rate in the Hall field is greater than in the applied one. (11 refs.)

67633 Relaxation currents in amorphous tantalum oxide in intense electric fields. V.V.Bryksin, M.N.D'yakonov, V.M.Muzhdaba, S.D.Khanin (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1520-2 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2682-5 (Sept. 1982). [received: April 1983]
The time dependence of the conductivity of amorphous tantalum oxide in intense electric fields is investigated. The hopping mechanisms of charge transfer is confirmed and an increase in the characteristic dimension of the cluster of states is observed experimentally. The critical hopping probability is determined. (11 refs.)

67634 Thermal phonon bottleneck and nonlinear current-voltage characteristics of conducting media. A.I.Vasker, Yu.G.Gurevich (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1698-700 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3000-3 (Oct. 1982). [received: April 1983]
The self-consistent process of heat transfer from a nonequilibrium (due to an applied heating electric field) conducting medium to an external thermostat (cryogenic liquid) is considered. Conditions are obtained for which ineffective cooling of a sample (phonon bottleneck in the heat transfer) is a mechanism for the formation of negative differential conductivity in solids. (13 refs.)

Thermal donors in silicon: consistent interpretation of Hall-effect and capacitance transient spectroscopy .... See Entry 67510

Estimation methods for localized-state distribution profiles in undoped and phosphorous-doped *a*-Si:H .... See Entry 67543

Ultrafast relaxations of photogenerated carriers in amorphous semiconductors .... See Entry 67640

Distribution of the intensity of recombination waves in a bounded semiconductor under transient conditions .... See Entry 67647

High electric field effect on negative magnetoresistance in Si (001) n-inversion layers .... See Entry 67654

Dark and photoconduction in azo dyes .... See Entry 67679

New calculations of the quantum yield of silicon in the near ultraviolet .... See Entry 67688

Metal-dielectric type transition in needle crystals of iodine and oxygen doped niobium-sulphur compounds .... See Entry 67704

Effect of boundary conditions on hot electron transport in short semiconductors .... See Entry 67762

Differential negative resistance caused by inter-subband scattering in a 2-dimensional electron gas .... See Entry 67766

Thermionic emission current in the MSM system .... See Entry 67806

72.20J Charge carriers: generation, recombination, lifetime, and trapping

67635 Polaron nature of charge carriers in silver azide. V.C.Kriger (Kemerovo State Univ., Kemerovo, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.805-8 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.960-3 (June 1982). [received: Feb. 1983]
It was found that if polaron effects are taken into account in silver azide it is possible to explain the regularities of electron-hole transfer and estimate the effective masses of carriers, their mobilities, and the energetic positions of defect levels in the forbidden band. It was shown that the holes may be localised in pairs on point and macrodefects. This must be taken into account when working out a mechanism of decomposition of azides. (18 refs.)

67636 Effects of interface-potential nonuniformities on carrier transport across silicon grain boundaries. D.J.Thomson, H.C.Card (Dept. of Electrical Engng., Univ. of Manitoba, Winnipeg, Manitoba, Canada).
J. Appl. Phys. (USA), vol.54, no.4, p.1976-80 (April 1983).
In an experimental investigation of electronic transport across individual grain boundaries in cast silicon, the authors have recently arrived at the conclusion that the diffusion potential at the grain boundary may in many cases exhibit appreciable variation over the boundary plane. The present paper describes an interpretation of the experimental observations in terms of a Gaussian distribution of interface potential over the grain-boundary surface, and a majority carrier transport to the boundary which is diffusion limited. In the grain boundaries studied the mean value of the diffusion potential was found to vary from $\langle V_d \rangle \simeq 0.70$ to $\langle V_d \rangle \simeq 0.32$ eV and the standard deviation from $\sigma \simeq 0$ to $\sigma \simeq 0.11$ eV. These values were derived from the change in activation energy with temperature. For the particular grain boundaries with spatial uniformity ($\sigma \simeq 0$) excellent agreement of the characteristics with an emission/diffusion model of majority-carrier transport is obtained. It is concluded (i) that it is not generally proper to assume that grain boundaries in cast silicon are spatially uniform and (ii) that the Gaussian distribution model provides a satisfactory first approximation to the spatial variation in grain boundaries. (10 refs.)

67637 Mechanism for relaxation of the phase of the electron wave function in *n*-type GaAs. O.V.Emel'yanenko, T.S.Lagunova, T.A.Polyanskaya (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.246-9 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.199-201 (20 Sept. 1982). [received: April 1983]
The phase relaxation time is estimated from the magnetic field dependences of the conductivity at liquid helium temperatures. It is shown that the phase relaxation time is determined by the electron-phonon collisions and the lifetime of single-particle excitations under conditions with short mean free paths. (9 refs.)

67638 TSC study of morphological modifications of rhodamine coloured PMMA. A.Chafai, D.Chatain, J.Dugas, C.Lacabanne (Lab. de Phys. des Solides, Univ. Paul Sabatier, Toulouse, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.335-8 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Rhodamine colored PMMA samples that may be used for solar collectors, have been studied by the thermostimulated currents technique. The comparison with pure PMMA data shows that the presence of rhodamine produces a thermostimulated peak at about 125°C. The analysis of its fine structure reveals the existence of relaxation modes characterized by relaxation times obeying a compensation law with a compensation temperature independent on the dye concentration. This phenomenon might be attributed to a morphological change of PMMA assigned to the rhodamine thermal degradation. (6 refs.)

67639 Harmonic generation due to ballistic electron transport in GaAs. D.Raychaudhuri, D.Chattopadhyay (Inst. of Radio Phys. & Electronics, Univ. of Calcutta, Calcutta, India).
Proc. IEEE (USA), vol.71, no.3, p.440-1 (March 1983).
Harmonics produced by the nonlinearity in the current-voltage characteristics of a ballistic diode are studied for a GaAs sample of thickness 1 μm at 77K under collision-free condition. Harmonic generation is found to be maximum at zero bias, the value for the second-harmonic current being 50 percent for a signal amplitude of 0.2 V. (2 refs.)

67640 Ultrafast relaxations of photogenerated carriers in amorphous semiconductors. J.Tauc (Dept. of Phys., Brown Univ., Providence, RI, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.889-93 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Electron relaxation effects in the range from 0.5 to 200 ps were studied in amorphous silicon and chalcogenide glasses using the pump and probe technique. Information about hot carrier thermalization and carrier trapping in shallow and deep states in the gap was obtained. (12 refs.)

67641 Carrier dynamics in optically illuminated a-Si:H. Y.Aoygi (Inst. of Phys. & Chem. Res., Saitama, Japan), S.Kumuro, Y.Segawa, S.Namba, H.Okamoto, Y.Hamakawa.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.894-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
It is found that in glow discharge a-Si:H the diffusion coefficient and the lifetime of the photo-excited carriers at the surface largely differ from those in the bulk, and the lifetime at the surface decreases drastically after the optical illumination. It is also found that a picosecond time relaxation of photo-excited carriers at the surface appears after an optical illumination in a-Si:H. The experimental results were explained by a multiple trapping mechanism taking account of the shallow and deep localized states increased after the optical illumination. (7 refs.)

67642 Distribution of recombination lifetimes in doped a-Si:H. D.K.Biegelsen, R.A.Street, W.B.Jackson (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.899-901 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Transient decay measurements of light-induced ESR are used to probe the distribution of recombination lifetimes in a-Si:H. The lifetimes are related to the densities of defect and band tail states at the quasi Fermi levels. (8 refs.)

67643 Kinetics of distant-pair recombination: application to amorphous silicon. D.J.Dunstan (Angewandte Phys., Johannes Kepler Univ., Linz, Austria).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.902-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The author presents an exact solution for the decay of randomly distributed excited carriers, and find that a monomolecular, distant-pair approximation is valid over a wide range of excitation powers. Under repetitively pulsed or continuous excitation, an accumulated pair population is present, the result of which is that the decay curve varies at high excitation power but is independent of excitation power at low power. In consequence, time-resolved experiments cannot distinguish between distant-pair and germinate recombination, and frequency-resolved methods must be used. He finds that distant-pair recombination provides a quantitative explanation of the experimental results in a-Si:H. (16 refs.)

67644 Electron-hole-pair generation and hysteresis in semiconductors. A.Elci, M.O.Schully (Max-Planck-Inst. fur Quantenoptik, Garching, Munchen, Germany), J.M.O'Hare.
Phys. Rev. B (USA), vol.27, no.8, p.4779-87 (15 April 1983).
The authors consider the electron-hole-pair generation and the resulting free-carrier-density buildup in a semiconductor irradiated with laser beams whose frequencies are below the band gap. Using a simple model, they show that the free-carrier density may exhibit hysteresis and that when placed in a cavity, the semiconductor causes optical multistability at relatively low input CW intensities. For InSb the model predicts hysteresis at or above ~ 100 W/cm^2. (9 refs.)

67645 Energy dependence of the carrier mobility-lifetime product in hydrogenated amorphous silicon. W.B.Jackson, R.J.Nemanich (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), N.M.Amer.
Phys. Rev. B (USA), vol.27, no.8, p.4861-71 (15 April 1983).
The results of optical-absorption measurements determined by photothermal deflection spectroscopy, primary photoconductivity, and secondary photoconductivity on undoped and phosphorus-doped hydrogenated amorphous silicon films (*a*-Si:H) are reported. A normalization procedure for obtaining photocurrent spectra at constant generation rate is demonstrated. From these measurements, the efficiency-mobility-lifetime product ($\eta\mu\tau$) for electrons is found to be constant from 2.0 to ~ 0.9 eV for both undoped and phosphorus-doped *a*-Si:H. For excitations less than ~ 0.9 eV, there is evidence that the product $\eta\mu\tau$ for electrons drops rapidly; similarly, the $\eta\mu\tau$ for holes exhibits a rapid decrease in undoped material for photon energies less than ~ 1.5 eV. A model is proposed to explain the results, resolving a discrepancy between secondary- and primary-photoconductivity measurements of the optical absorption. (27 refs.)

67646 Electron beam induced conductivity in 'PET' and 'FEP'. S.J.Walzade, J.P.Jog, S.B.Dake, S.V.Bhoraskar (Dept. of Phys., Univ. of Poona, Pune, India).
Solid State Commun. (USA), vol.46, no.5, p.393-6 (May 1983).
Electron Beam Induced Conductivity (EBIC), classified into EBIC (bulk) and EBIC (surface) have been measured in PET and FEP respectively. The peculiar oscillatory nature of the induced gain versus beam energy variations is explained in terms of spatial distributions of the trapping centres near the surface of the polymers. (11 refs.)

67647 Distribution of the intensity of recombination waves in a bounded semiconductor under transient conditions. I.V.Karpova, V.A.Sablikov, S.M.Syrovegin (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1267-71 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1963-8 (Nov. 1982). [received: April 1983]
An active region in the form of a sharp maximum of the time-average value of the electric field forms in a semiconductor under conditions favoring excitation of recombination waves. Theoretical and experimental investigations are reported of the process of formation of such an active region during the transient stage following the application of a voltage pulse which excites low-amplitude recombination waves. It is shown that even during this initial stage of the development of an instability the intensity of recombination waves has a maximum at that point in a sample where an active region forms subsequently. Other arguments are adduced to show that the active region is due to recombination waves themselves and represents one of the nonlinear effects that accompany the growth of such waves. (10 refs.)

67648 Validity of the effective lifetime concept in polycrystalline silicon. S.C.Jain (Solidstate Phys. Lab., Delhi, India), R.Janssens, G.Cheek, P.DePauw, R.Mertens, R.van Overstraeten.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.432-6
Polycrystalline silicon currently has much technological importance for potential photovoltaic applications. In the paper the effective lifetime concept of minority carriers, often used for solar cell calculations, is examined. The effective grain boundary surface recombination velocity, S_{eff}^{GB}, is not linear in n, the minority carrier concentration. The problem can be made linear if S_{eff}^{GB} is very large such that the diffusion current to the grain boundary is limited by the diffusion velocity. However, in general a large S_{eff}^{GB} makes the series $n(x,y,z)=\Sigma\ \Sigma\ n_{i,j}(x,y,z)$ slowly convergent and the cell cannot be described by one τ_{eff}. It is found that for calculating Isc, the concept of τ_{eff} works as a special case. The error in the calculation of the dark saturation current becomes larger, the principle of superposition becomes invalid and Voc cannot be calculated using the concept of τ_{eff}. (6 refs.)

Surface recombination velocity in a silicon optical waveguide ..See Entry 66383

Recombination enhanced dislocation glide in InP single crystals ....See Entry 66994

Measurements of dispersive phonon transport in gallium phosphide ....See Entry 67127

Solid solubility and precipitation of phosphorus and arsenic in silicon solar cells front layer ....See Entry 67226

Electrical conductivity and nature of the charge carriers in single crystals of compounds Cs_2HgX_4 (X=Cl, Br, I) ....See Entry 67268

Electron-hole recombination effect on the quantum oscillations of sound velocity for $q \wedge H \sim 90°$ in dilute $Bi_{1-x}Sb_x$ alloys ....See Entry 67428

Valence-band parameters and hole mobility of Ge-Si alloys—theory ....See Entry 67442

Magnetoresistive determination of localization effects in InSb ....See Entry 67502

A novel technique for studying electric field effect of carrier emission from a deep level center ....See Entry 67506

Dissociation of (Zn,O) pairs in GaP ....See Entry 67517

Auger effect at localized impurities in semiconductors ....See Entry 67518

Dynamical theory of recombination-enhanced defect reactions ....See Entry 67524

Impurity states in n-type $Hg_{1-x}Cd_xTe$ in high magnetic field and under hydrostatic pressure ....See Entry 67526

Electrical and optical properties of black phosphorus single crystals ....See Entry 67605

Theory of relaxation of hot electrons and oscillatory photoconductivity in polar semiconductors ....See Entry 67626

Relaxation currents in amorphous tantalum oxide in intense electric fields ....See Entry 67633

Dark and photoconduction in azo dyes ....See Entry 67679

Recombination effects on transient photocurrent in a-Si:H ......See Entry 67687

New calculations of the quantum yield of silicon in the near ultraviolet ....See Entry 67688

Residual conductivity in $GdIn_3S_6$ crystals ....See Entry 67691

Kinetics of charging of copper impurity centers in Ge during strong laser excitation ....See Entry 67693

Grain boundaries and intragrain defects dependence of local and global electronic and photovoltaic properties of CGE polysilicon ....See Entry 67699

Surface recombination waves in semiconductors ....See Entry 67745

Determination of the generation lifetime and surface generation velocity by voltage step method ....See Entry 67786

Modification of the transient capacitance analysis of GaAs MIS structures for minority carrier lifetime determination ....See Entry 67788

Electron-electron scattering in silicon inversion layers ....See Entry 67789

Determination of deep trap density in *n*-type epitaxial GaAs ..See Entry 67811

Physical and electrical properties of polycrystalline silicon thin films ....See Entry 67825

Electron-hole recombination in As_2Se_3 ....See Entry 68085

Photoabsorption in amorphous semiconductors using a wave guided CO_2 laser ....See Entry 68160

Initial stage in the redistribution of photoinduced charges and electric fields in $Bi_{12}SiO_{20}$ ....See Entry 68177

Observation of a Soret-Dufour effect for laser-generated carriers in germanium ....See Entry 68224

Deposition and properties of zinc phosphide films ....See Entry 68454

Study of the grain boundary effects in N-P junction polycrystalline Si solar cells ....See Entry 68888

72.20M Galvanomagnetic and other magnetotransport effects

67649 Quantized Hall conductance: effect of random potentials. W.Brenig (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Z. Phys. B (Germany), vol.50, no.4, p.305-9 (1983).
The effect of random potentials on the Hall current is expressed in terms of a sum of level shift functions $\eta(\epsilon)$. These functions obey a generalized Levinson theorem: $\eta(\bar{\epsilon})$-$\eta(\underline{\epsilon})=\pi N_b=$number of localized states where $\bar{\epsilon}$ and $\underline{\epsilon}$ are the upper and lower mobility edge respectively of a band of extended states. As a consequence of that the total Hall current carried by a band of extended states originating from a Landau level remains unaffected by a random potential independent of the number of bound states split off from the continuum. (10 refs.)

67650 Low-field galvanomagnetic tensor components for electrons in bismuth. M.M.Krishna (Cryogenics Section, Nat. Phys. Lab., New Delhi, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.930-7 (Dec. 1982). [received: April 1983]
Azbel-Kaner cyclotron resonance and magnetic field induced surface state resonance show that the law of dispersion for electrons in bismuth follows the Cohen's model $(E-p_2{}^2/2m_2)(1+E/E_g+p_2{}^2/2m'_2E_g)=p_1{}^2/2m_1+p_3{}^2/2m_3$ with ellipticity parameter $p=m_2/m_2' \neq 1$. The results for twelve weak field galvanomagnetic tensors are presented for electrons in bismuth using Cohen's multivalley model and anisotropic scattering time. The three valleys are situated at the L-point of the Brillouin zone and separated from each other by ±120° rotation about the trigonal axis. Special cases of the author's results show that earlier calculations of galvanomagnetic tensors for a parabolic model ($E_g \rightarrow \infty$ in Cohen's model) by Freedman and Jurestschke [Phys. Rev. (USA), vol.124, p.1379, 1961] contain an error in tensor component σ_{2323} and Cohen's model with $p=1$ by V.S. Voloshin [Sov. Phys.-Solid State (USA), vol.13, p.899, 1971] contains error in L_4 and σ_{2323}. (11 refs.)

67651 Saturation of Si activation at high doping levels in GaAs. T.C.Banwell, M.Maenpaa, M.-A.Nicolet (California Inst. of Technol., Pasadena, CA, USA), J.L.Tandon.
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.507-14 (1983).
Ion implantation of Si is extensively employed in the fabrication of GaAs integrated circuits as an *n*-type dopant. The authors have investigated the electrical activation of Si in GaAs with high dose (10^{17}-10^{19} cm^{-3}) room temperature Si implantations in semi-insulating GaAs. A co-implantation of As with Si was used to study the influence of local stoichiometry and substrate morphology on the electrical activation of Si. A van der Pauw method was employed for electrical characterisation. The results show that the previously reported saturation in the free electron concentration at 2×10^{18} cm^{-3} is not altered by coimplanted As. The authors compile their results with those of several publications to obtain the electrical activation after $\sim 850°$C annealing for implanted Si in the concentration range 10^{16}-10^{20} Si cm^{-3}. A quantitative description of the saturation effect is presented and discussed in terms of a simple saturation mechanism. (24 refs.)

67652 On the conduction band anisotropy in semimagnetic semiconducting $(Cd_{1-x}Mn_x)_3As_2$ alloys. F.A.P.Blom, J.J.Neve, P.A.M.Nouwens (Dept. of Phys., Eindhoven Univ. of Technol., Eindhoven, Netherlands).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.470-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Shubnikov-de Haas (SdH) measurements have been carried out on $(Cd_{1-x}Mn_x)_3As_2$ alloys with low Mn contents. The anisotropy in the SdH oscillation periods can be explained by a warped Bodnar type Fermi surface. The angular dependence of the electronic effective g-factor is not as strong as has been predicted by theory. (9 refs.)

67653 Magnetoresistance of the 2-D impurity band in silicon inversion layers. A.Hartstein, A.B.Fowler (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), K.C.Woo.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.655-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The effect of a magnetic field perpendicular to the surface on the conductance of the two-dimensional (2-D) Na^+ induced impurity band in silicon inversion layers has been studied. The temperature dependence of the conductance at low fields (H<5 T) is $\sigma=\sigma_0\exp\text{-}(T_0/T)^{1/3}$, which is expected for variable range hopping in 2-D when the impurity wave functions are hydrogenic. At higher fields (H>10 T), $\sigma=\sigma_0'\exp\text{-}(T_0'/T)^{1/2}$, which should result for Landau (Gaussian) impurity wave functions. In this high field regime the authors observe $T_0'=aH$, where a depends only on the density of states at the Fermi level and fundamental constants. (9 refs.)

67654 High electric field effect on negative magnetoresistance in Si (001) n-inversion layers. Y.Kawaguchi (Gakushuin Women's Junior Coll., Tokyo, Japan), S.Kawaji.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.658-60 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Electric field (E_{SD}) dependence of negative magnetoresistance in silicon (001) MOS inversion layers has been measured at the field from 0.4 V/m to 1000 V/m at 1.1K and 4.2K. The E_{SD} dependence of the negative magnetoresistance is explained by E_{SD} dependence of inelastic scattering time of electrons due to the change in electron temperature by the field. Energy transfer of electrons to the lattice is well explained by the surface scattering theory with the bulk value of deformation potential constant for the $Si\text{-}SiO_2$ interface. (6 refs.)

67655 Magnetoresistance in weakly localized regime. H.Fukuyama (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.676-81 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A review is given on the recent microscopic investigation of the magnetoresistance in the weakly localized regime of semiconductors both in two and three dimensions. Agreement between theory and experiment on Si-MOS and doped semiconductors is seen to be satisfactory. (49 refs.)

67656 The quantum Hall effect. K.V.Klitzing, G.Ebert (Phys. Dept., Tech. Univ. Munchen, Garching, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.682-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Hall effect measurements on a two-dimensional electron gas, realized with different types of semiconductor devices, show that the Hall conductivity at low temperatures and high magnetic fields becomes quantized in units of e^2/h. This quantity has been measured with an uncertainty of less than 10^{-6} and agrees with the officially recommended value. This result has initiated a large number of publications which discuss the question of why the measured value for the Hall conductivity is not significantly influenced by microscopic details of the semiconductor. (25 refs.)

67657 Observation of quantized Hall effect and vanishing resistance at fractional Landau level occupation. H.L.Stormer (Bell Labs., Murray Hill, NJ, USA), D.C.Tsui, A.C.Gossard, J.C.M.Hwang.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.688-90 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Quantization of the Hall resistance ρ_{xy} and the approach of a zero-resistance state in ρ_{xx} are observed at fractional filling of Landau levels in the magnetotransport of the two-dimensional electrons in GaAs-(AlGa)As heterostructures. At the lowest temperatures (T~0.5K), the Hall resistance is quantized to values $\rho_{xy}=h/(1/3\ e^2)$ and $\rho_{xy}=h/(2/3\ e^2)$. This observation, unexpected from current theoretical models for the quantized Hall effect, suggests the formation of a new electronic state at fractional level occupation. (13 refs.)

67658 Electron localization and the quantized Hall resistance in silicon inversion layers. J.Wakabayashi (Cavendish Lab., Univ. of Cambridge, Cambridge, England), H.W.Myron, M.Pepper.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.691-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Investigates the formation of the plateau of quantized Hall resistance in the spin split minimum and the lowest valley split minimum of the ground Landau level of (100) Si inversion layers. The results in the spin gap are explained by a model based on Anderson localization in strong magnetic fields and on the existence of long range potential fluctuations. The behaviour of ρ_{xy} in the second, spin up, higher valley, level is discussed in relation to the compensation effect suggested in recent theories. Application of a field of 25 Tesla resulted in the delocalization of electrons in the lowest valley level and the appearance of the plateau of quantized Hall resistance in the lowest valley gap. (18 refs.)

67659 Threshold scattering of conduction electrons by magnetic impurities in semimagnetic semiconductors subjected to a strong magnetic field. I.I.Lyapilin (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1253-6 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1942-6 (Nov. 1982). [received: April 1983]
It is shown that the overlap of the conduction and valence bands which appears in semimagnetic semiconductors with suitable values of the parameters N, H, and T (N is the concentration of a transition element, H is a magnetic field, and T is the absolute temperature) gives rise to a new channel for the scattering of conduction electrons which involves electron transitions from the conduction to the valence band. This scattering mechanism has threshold and it gives rise to a nonmonotonic dependence of the resistance on the magnetic field at a fixed temperature. (11 refs.)

67660 Investigation of the Hall effect in liquid gallium antimonide near the melting point. V.M.Glazov, V.B.Kol'tsov, S.Gaforov (Inst. of Electronic Technol., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1265-7 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1959-62 (Nov. 1982). [received: April 1983]
The Hall effect in liquid gallium antimonide near the melting point was investigated for the first time. Beginning from the melting point it was found that the temperature dependence of the Hall coefficient could be explained by the concept of aftermelting on the basis of a cluster model used to estimate quantitatively the magnitude of the effect. Estimates were obtained of an abrupt change in the carrier density at the melting point of gallium antimonide, which confirmed completely the metallic nature of the melt of this compound. The results obtained were used to calculate the electron component of the entropy of fusion of gallium antimonide, which agreed well with earlier model calculations. (17 refs.)

67661 Localized magnetic moments in $Bi_{1-x}Sb_x$ semiconductor alloys. A.A.Zhukov, V.G.Karavaev, A.A.Kudryashov, L.Skrberk, S.M.Chudinov (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1678-82 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2963-71 (Oct. 1982). [received: April 1983]
Galvanomagnetic effects in single crystals of $Bi_{1-x}Sb_x$ $(0.075\leq x\leq 0.18)$ *n*-type semiconductor alloys with carrier impurity densities $n=(2.10^{13}-3.10^{15})$ cm^{-3} (the doping impurities are not magnetic) are investigated. The investigation were carried out in magnetic fields up to 65 kOe in the temperature range $0.02K\leq T\leq 200K$. The temperature dependence of the resistance in the temperature range (1.5-8)K has a logarithmic form. When $T<1K$, after a quite wide maximum, a reduction in the resistance as the temperature falls is observed. The dependence of ρ on T in the range (0.2-0.6)K is linear, and when $T\sim(0.1\text{-}0.2)K$ it becomes quadratic. A negative magnetoresistance and an anomalous Hall effect was observed in the alloys investigated. These anomalies in the temperature dependence of the galvanomagnetic coefficients can be understood by assuming that localized magnetic moments exist in these alloys. Possible mechanisms by which these magnetic moments are formed are discussed. (18 refs.)

Determination of the fine structure constant using MOS devices .... See Entry 64877

Investigation of the structure of solid solutions of elements of the IV. Group (Si, Ge) in gallium antimonide .... See Entry 66940

Effective ρ-type doping of diamond by boron ion implantation .... See Entry 67026

Doping mechanism and properties of Zn-doped GaN-epitaxial layers .... See Entry 67381

Magnetophonon oscillation in the conduction band and phonon-drag-enhanced magnetophonon peak of thermoelectric power of tellurium ...... See Entry 67436

Spin interaction enhanced anisotropy of the band overlap in $Hg_{.97}Mn_{.03}Te$ .... See Entry 67444

Magnetic field induced nonmetal-metal transition in the open-gap $Hg_{1-x}Mn_xTe$ .... See Entry 67452

Mott transition in layer semiconductors .... See Entry 67458

Magnetoresistive determination of localization effects in InSb .... See Entry 67502

Defect nature of the 0.4-eV center in O-doped GaAs .... See Entry 67505

Thermal donors in silicon: consistent interpretation of Hall-effect and capacitance transient spectroscopy .... See Entry 67510

Study of impurity states in a *n-n* GaAs-AlGaAs heterojunction using cyclotron resonance and Shubnikov-de Haas experiments .... See Entry 67511

Magnetoresistance in Anderson-localized systems .... See Entry 67553

Negative mobility in the extreme quantum limit of transverse galvanomagnetic conduction .... See Entry 67560

Strain scattering of electrons in piezoelectric semiconductors . See Entry 67581

Carrier drag by phonons in semiconductors having an arbitrary isotropic band .... See Entry 67585

Resistivity, Hall mobility and leakage current variations in undoped semi-insulating GaAs crystal grown by LEC method .... See Entry 67590

Delocalization of H^--like impurity states and formation of band type impurity conductivity in semiconductors .... See Entry 67604

Electrical and optical properties of black phosphorus single crystals .... See Entry 67605

Transport phenomena of hot holes anomalously distributed in a warped energy band of silicon .... See Entry 67624

Mechanism for relaxation of the phase of the electron wave function in *n*-type GaAs .... See Entry 67637

Magnetophonon oscillation of thermoelectric power—anomalous behaviour in p-type-to-intrinsic transition region of InSb .... See Entry 67666

Transport parameters of partially illuminated semiconductors .... See Entry 67690

Kinetics of charging of copper impurity centers in Ge during strong laser excitation .... See Entry 67693

Loss of dimensionality, localisation and conductance oscillations in n-type GaAs FETs .... See Entry 67710

Electron mobility and Landau level width modulation-doped $GaAs\text{-}Al_xGa_{1-x}As$ heterojunctions .... See Entry 67763

Electron-electron scattering in silicon inversion layers .... See Entry 67789

Non-metallic transport in silicon inversion layers and the Hall effect .... See Entry 67790

Valley splitting and valley degeneracy in n-type silicon (110) inversion layers .... See Entry 67792

Observation of the second subband occupation in the *p*-type (111) Si inversion layer .... See Entry 67798

Electrical properties of $AgGaSe_2$ epitaxial layers .... See Entry 67809

Electronic properties of microcrystalline silicon prepared in the glow discharge plasma .... See Entry 67815

Size anisotropy of the transverse magnetoresistance of epitaxial *n*-type GaAs films .... See Entry 67818

Change in electrophysical properties of PbTe thin films under the action of oxygen .... See Entry 67819

The nature of the superconducting state in PbTe doped with thallium .... See Entry 67842

Direct observation of ferroelectric phase in $Pb_{1-x}Sn_xTe$ .... See Entry 68134

72.20N Thermomagnetic effects

67662 **Two thermomagnetic effects and the electronic thermal conductivity in *p*-GaSb.** S.K.Patapis (Dept. of Phys., Univ. of Athens, Athens, Greece).
Solid State Commun. (USA), vol.46, no.7, p.527-9 (May 1983).
Two thermomagnetic effects are studied in single crystal p-GaSb. The influence of a weak magnetic field, up to 20 kG, upon the thermoelectric effect and the thermal conductivity of the semiconductor for different temperatures is investigated. From the measurement of the change of the above transport properties in a magnetic field, conclusions concerning their field and temperature dependence, the *r* (exponent in scattering law) and the electron components of the thermal conductivity and their dependence on temperature have been derived. (13 refs.)

72.20P Thermoelectric effects

67663 **Nonlinear *I-V* behaviour and thermo-EMF in amorphous semiconducting selenium-tellurium alloys.** J.K.Zope (Dept. of Phys., Shivaji Univ., Kolhapur, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.774-6 (Oct. 1982). [received: April 1983]
Amorphous semiconducting compounds of the composition $Se_{20}Te_{80}$, $Se_{15}Sb_5Te_{80}$ and $Se_{10}Sb_{10}Te_{80}$ are studied for their *I-V* characteristics and thermoelectric power. It has been observed that the nonlinear *I-V* behaviour for the on-state is a function of the presence of antimony in the sample. The On-state voltage shifts to lower voltage value as antimony increases in the sample. The material becomes conducting due to the presence of antimony. All the samples are of *p*-type in nature. The thermoelectric power decreases when the quantity of antimony increases in the samples. The nonlinear *I-V* behaviour, the *p*-type nature and the decrease of *Q* when antimony is present in the sample, are discussed on the basis of the charged defect states existing in the material. Higher content of antimony in the samples shows a metallic nature and the *I-V* curve is linear. (15 refs.)

67664 **The thermoelectric power of TaS_3.** B.Fisher (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Solid State Commun. (USA), vol.46, no.3, p.227-8 (April 1983).
The thermoelectric power of TaS_3 filaments was measured as a function of temperature between 90-400K. Its positive sign in the whole temperature range and its linear dependence on reciprocal temperature between 120-200K are discussed in connection with the temperature dependence of the resistance. (6 refs.)

67665 **Thermoelectric characteristics of anisotropic thermoelements made of elastically deformed *n*-type silicon crystals.** P.I.Baranskii, E.N.Vidalko, V.V.Savyak (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1300-2 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2015-17 (Nov. 1982). [received: April 1983]
An investigation was made of the thermoelectric power, piezothermoelectric power, and thermoelectric figure of merit of undeformed and uniaxially deformed *n*-type Si crystals at $T=85$K with electron densities in the range $1.9\times10^{13}\le n_e\le 2.6\times10^{16}$ cm^{-3}. It was found that, in spite of the high thermal conductivity which increased in the case of *n*-type Si as a result of cooling, these crystals could exhibit (in an elastically deformed state) a thermoelectric figure of merit comparable with that of the most widely used thermoelectric materials. The anisotropy of the thermoelectric power (governing the sensitivity of an anisotropic thermoelement) of uniaxially deformed *n*-type Si exceeded the anisotropy of commonly used thermoelectric materials by two orders of magnitude. (11 refs.)

67666 **Magnetophonon oscillation of thermoelectric power—anomalous behaviour in p-type-to-intrinsic transition region of InSb.** K.Takita.
Solid State Phys. (Japan), vol.17, no.12, p.717-23 (Dec. 1982). In Japanese. [received: April 1983]
Amplitude enhancement and abrupt phase-shift of magnetophonon oscillation of thermoelectric power are interpreted as arising from enhanced electron diffusion, which is induced by rapidly increasing the electron concentration in the p-type-to-intrinsic transition region. (11 refs.)

67667 **Thermo-EMF of cells with a $ZrO_2+Y_2O_3$ electrolyte in atmospheres of different compositions.** G.I.Fadeev, M.V.Perfil'ev (Inst. of Electrochem., Acad. of Sci., Sverdlovsk, USSR).
Sov. Electrochem. (USA), vol.18, no.7, p.894-7 (July 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.7, p.1004-6 (July 1982). [received: March 1983]
The theoretical question of the thermo-EMF of cells with a solid oxide electrolyte based on zirconium dioxide has been considered previously. The experimental results available at the present time relate to the electrolytes ZrO_2+CaO, $ZrO_2+Sc_2O_3$, and $ZrO_2+Y_2O_3$. The thermo-emf measurements were carried out in an atmosphere of inert gas$+O_2$ at temperatures of 800-1200°C. The results of the measurements agree well with theory. In the paper the authors give the results of measurements of the coefficient of the thermo-emf in mixtures of gases: in inert gas$+O_2$, $CO+CO_2$, and H_2+H_2O in the temperature range of 400-900°C, and these results are compared with the theoretical calculations. (8 refs.)

67668 **The preparation of fine grained thermoelectric alloys by vacuum hot pressing.** D.M.Rowe (Dept. of Phys., Electronics & Electrical Engng., Univ. of Wales Inst. of Sci. & Technol., Cardiff, Wales).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.487-95
N-type silicon germanium alloy compacts of the composition $Si_{63.5}$ $Ge_{36.5}$ and with a grain size (L) in the range $10<L<25$ μm, $5<L<10$ μm and <5 μm have been prepared by vacuum hot press sintering at temperatures close to the alloy solidus temperature (1200°C) and at pressures of $\sim$200 MPa. The compacts were better than 98% dense compared to equivalent single crystal material and little if any grain growth has occurred. Initial measurements of the thermoelectric transport properties confirm the theoretical prediction that the lattice thermal conductivity decreases with a reduction in grain size. At room temperature the lattice thermal conductivity of the 'single crystal' starting material is equal to 4.31 W m^{-1} K^{-1} and falls to 3.10 W m^{-1} K^{-1} in the compact with a grain size <5 μm, a reduction of $\sim$28%. Within experimental error the Seebeck coefficient and electrical resistivity do not change with a reduction in grain size. It is concluded that the thermoelectric conversion efficiency of the alloy would be significantly improved through the use of fine-grained material. (18 refs.)

Magnetophonon oscillation in the conduction band and phonon-drag-enhanced magnetophonon peak of thermoelectric power of tellurium ...... See Entry 67436

Reduced problem of thermoelectricity for isotropic media .... See Entry 67555

Carrier drag by phonons in semiconductors having an arbitrary isotropic band .... See Entry 67585

Electrical conductivity of Ni-Zn ferrites .... See Entry 67595

Influence of impurities on the electrical properties of $Se_{65}Te_{35}$ glasses .... See Entry 67609

Two thermomagnetic effects and the electronic thermal conductivity in *p*-GaSb .... See Entry 67662

Thermomagnetic coefficients of inversion layer in high magnetic field .... See Entry 67791

Electronic properties of microcrystalline silicon prepared in the glow discharge plasma .... See Entry 67815

Electronic transport in hydrogenated amorphous silicon .... See Entry 67817

Change in electrophysical properties of PbTe thin films under the action of oxygen .... See Entry 67819

Radiation and spectral characteristics of sapphire crystals produced by various methods .... See Entry 68254

Preparation and electrical properties of $La_{2-x}Sr_xNiO_4$ ($x=0$-1.0) .... See Entry 68466

Interaction in the Bi_2Te_3-La_3Te_4 system .... See Entry 68523

72.30 HIGH-FREQUENCY EFFECTS; PLASMA EFFECTS

67669 **Giant quantum oscillations of the non-local damping of coupled helicon-phonon modes.** R.Idiculla, K.S.Viswanathan (Dept. of Phys., Univ. of Kerala, Trivandrum, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.808-11 (Oct. 1982). [received: April 1983]
A numerical study has been made of the nonlocal damping of coupled helicon-phonon modes for the case when quantum effects are significant. It is found that the phonon damping also undergoes giant quantum oscillations in the interaction region. The results confirm the mode conversions that take place due to interaction and the hybrid nature of the coupled modes. (4 refs.)

67670 **Relaxation kinetics in polar semiconductors.** A.J.C.Sampaio (Dept. de Fisica, Univ. Federal do Ceara, Ceara, Brazil), R.Luzzi.
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.479-88 (1983).
The nonequilibrium thermodynamics and relaxation kinetics of a photoexcited plasma in polar semiconductors are discussed using a nonequilibrium statistical mechanics method that allows for the derivation of the nonlinear transport equations which describe the evolution of the irreversible phenomena that take place in the system. The theoretical results are compared with data obtained from ultra-fast time-resolved optical spectroscopy of GaAs and show good agreement. The role of the relevant relaxation channels is discussed, and it is shown that a theoretical and numerical study provides a description of the mechanisms for energy losses which accounts for the behaviour observed in this kind of system in several experiments reported so far. (24 refs.)

67671 **Oscillation of the transparency of metals in a weak magnetic field.** M.A.Lur'e, V.G.Peschanskii, K.Yasemidis (A.M. Gorki State Univ., Sverdlovsk, USSR).
JETP Lett. (USA), vol.36, no.6, p.238-41 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.193-5 (20 Sept. 1982). [received: April 1983]
It is shown that under the conditions of the anomalous skin effect in a weak magnetic field H, parallel to the surface of a conductor, effective electrons form not only the skin layer but also a weakly damped component of the electromagnetic field. As a result, the transparency of thin metallic plates in the microwave range oscillates as a function of the magnetic field, while the period of these oscillations with respect to $H^{-1/2}$ is determined by the location characteristics of the Fermi surface. (3 refs.)

67672 **Stimulated Brillouin scattering of transversely polarized electromagnetic waves in magnetoactive moderately piezoelectric semiconductor plasmas.** S.Ghosh, S.Khan (School of Studies in Phys., Vikram Univ., Ujjain, India).
Phys. Status Solidi b (Germany), vol.116, no.1, p.323-34 (1 March 1983).
An analytical investigation is made of the stimulated Brillouin scattering of a large amplitude, transversely polarized, electromagnetic pump wave produced by both, an electron-plasma wave and acoustical phonon vibrations in a magnetoactive n-type moderately piezoelectric semiconductor. Using the hydrodynamical model of plasma, the general dispersion relation is obtained in the presence of a large magnetostatic field applied at an arbitrary angle θ to the direction of propagation of the pump wave. The analysis is applied to both the cases of isotropic ($B_0=0$) and magnetoactive ($B_0\neq0$) plasmas. The threshold electric field necessary for the onset of Brillouin instability and the growth rate of the unstable Brillouin mode well above the threshold are studied. It is concluded that the threshold pump amplitude as well as the growth rate are strongly dependent on the orientation of the magnetostatic field with respect to the directions and magnitudes of the wave vectors $\mathbf{k}$ and $\mathbf{k}_1$ of the acoustic and scattered electromagnetic waves, respectively. (23 refs.)

67673 **Excitation of magnetoacoustic waves by two microwave beams in InSb.** K.P.Maheshwari, G.Tarey (Dept. of Phys., Government Coll., Kota, India).
Phys. Status Solidi b (Germany), vol.116, no.1, p.339-46 (1 March 1983).
An investigation is made of the resonant excitation of magnetoacoustic wave at the difference frequency of two microwave beams propagating in a magnetoactive solid state plasma, namely n-InSb. Due to the interaction of the two waves in the semiconductor the ponderomotive force at the difference frequency becomes finite and generates a magnetoacoustic wave if the dispersion relation corresponding to magnetoacoustic wave is satisfied. The analysis shows that there is a finite probability of excitation of an acoustic wave alongwith the magnetoacoustic wave. The excited acoustic and magnetoacoustic waves couple at magnetic fields when the thermal pressure is equivalent to the magnetic pressure. The propagation characteristics of the coupled wave are also studied. The results show that microwave beams of power densities 1 MW cm^{-2} excite magnetoacoustic wave of power density 0.04 kW cm^{-2} when $\omega_c/\omega=0.1$. The increase in magnetic field increases the power density of the excited magnetoacoustic wave whereas it tends to reduce the refractive index and attenuation constant of the coupled wave. (12 refs.)

67674 Cooling rates of highly photoexcited electron-hole plasmas in semiconductors. P.Kocevar (Univ. Graz, Graz, Austria), W.Potz, W.Porod.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.220-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reduction of the cooling rates of highly photoexcited electron-hole plasmas in semiconductors by more than one order of magnitude with respect to standard theoretical predictions are explained by the detailed time dependence of the disturbed optical phonon distributions. (11 refs.)

67675 Instability of the electron-hole plasma in covalent semiconductors. M.Combescot, J.Bok (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1014-16 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors show that the electron-phonon interaction in covalent semiconductors drives an instability in the electron-hole plasma at high temperature. This instability might be the reason for melting of tetrahedrally bound semiconductors. Numerical values are given for germanium and silicon. This model predicts a very high concentration of e-h pairs near melting. (11 refs.)

67676 Electromagnetic waves in a polar semiconductor subjected to an external magnetic field. L.E.Gurevich, D.A.Filippov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1274-5 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1974-6 (Nov. 1982). [received: April 1983]
A theoretical analysis is made of the propagation of electromagnetic waves in an isotropic polar semiconductor subjected to a homogeneous magnetic field. It is shown that the influence of this magnetic field and the interaction with optical lattice vibrations change significantly the properties of such waves. New oscillation (vibration) branches appear, there are new resonances and new limited ranges of frequencies in which these branches exist. (2 refs.)

67677 A germanium oscillator in a pulsed magnetic field. V.I.Gaman, G.F.Karavaev, G.F.Karlova (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.613-17 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.38-41 (July 1982). [received: May 1983]
Experimental data which confirms the presence of hysteresis of the magnetic threshold field of the helical instability of the plasma in a germanium oscillator are presented. It is shown that hysteresis of the threshold magnetic field is due to the inertia of the change in the effective lifetime of the charge carriers in the specimen when the magnetic field is increased and reduced. The dependence of the hysteresis of the theshold magnetic field on the electric field strength, the magnetic field, and the temperature is discussed. (14 refs.)

Structure of an excited weakly ionized plasma with a discontinuously moving neutral component .... See Entry 66707

Direct evidence for screening of carrier-acoustic phonon interaction at low to medium carrier densities in GaAs .... See Entry 67622

Combined breakdown in bismuth-antimony semiconductor alloys .... See Entry 67632

Surface impedance of thin plates during bilateral electromagnetic field excitation .... See Entry 67746

Size anisotropy of the transverse magnetoresistance of epitaxial *n*-type GaAs films .... See Entry 67818

Effect of anodic growth temperature on native oxides of *n*-(Hg, Cd)Te .... See Entry 67826

Exciton of surface helicons by the method of frustrated total internal reflection .... See Entry 67828

Observation of a Soret-Dufour effect for laser-generated carriers in germanium .... See Entry 68224

72.40 PHOTOCONDUCTION AND PHOTOVOLTAIC EFFECTS; PHOTODIELECTRIC EFFECTS

67678 Study of optically induced degradation of conductivity in hydrogenated amorphous silicon by transient grating method. S.Komuro, Y.Aoyagi, Y.Segawa, S.Namba (Inst. of Phys. & Chem. Res., Saitama, Japan), A.Masuyama, H.Okamoto, Y.Hamakawa.
Appl. Phys. Lett. (USA), vol.42, no.9, p.807-9 (1 May 1983).
Optically induced degradation of the conductivity (the Staebler-Wronski effect) in glow discharge hydrogenated amorphous Si was examined by a transient grating method. It was clarified that the Staebler-Wronski effect was a bulk and not a surface effect, and the origin of the decrease of the photoconductivity was mainly attributed to the decrease of the lifetime instead of the mobility. (13 refs.)

67679 Dark and photoconduction in azo dyes. J.P.S.Chauhan, R.C.Rai, A.K.Tripathi, S.C.Mathur (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.149-52 (April 1983).
The authors report dark and photoconductivities studies on two important azo dyes, Eriochrome Black T (EBT) and Eriochrome Blue Black B (EBBB). It is found that the activation energies for photoconduction for these dyes are much smaller than the activation energies for dark conduction suggesting that the photogenerated charge carriers are getting trapped. These trapped charge carriers are released on heating the sample and give rise to electrical conduction. (11 refs.)

67680 Mechanism of hole injection on ferric oxide photoelectrodes. T.Pajkossy (Central Res. Inst. for Phys., Acad. of Sci., Budapest, Hungary).
J. Electrochem. Soc. (USA), vol.130, no.3, p.632-5 (March 1983).
It seems that ferric oxide is advantageous as a semiconductor photoelectrode for utilizing solar energy. Ferric oxide is an n-type semiconductor, its bandgap is reasonable for such purposes, it can be manufactured easily and cheaply, and it is reasonably stable. It does, however, suffer from the disadvantage of low quantum efficiency. The efficiency can be increased if the surface processes are understood, and it is known how to suppress surface recombination. The author determines whether hole injection at the interface proceeds directly from the valence band or via surface states. The photocurrent was measured on ferric oxide electrodes at constant electrode potential and slightly modulated illumination as a function of reducing agent concentration. The average value of the photocurrent was measured directly, and the current transients due to light modulation were recorded, using the signal averaging technique. (17 refs.)

67681 The internal photoelectric effect in InSb with L-band participation. A.R.Beattie (Dept. of Appl. Math., Univ. Coll., Cardiff, Wales).
J. Phys. C (GB), vol.16, no.12, p.2265-80 (30 April 1983).
A theoretical calculation of the quantum efficiency of the internal photoelectric effect in InSb is made. In addition to electron and light-hole impact ionisation and intraband thermalising processes (deformation potential, optical polar mode phonons and particle-particle collisions) there are also included the near-horizontal transitions between the Γ and L conduction bands and between the light-hole and heavy-hole bands. There is good agreement with experiment, with the suggestion that either the L band is lower in energy than previously thought or that there is also the participation of a localised level associated with the L band. (13 refs.)

67682 Effect of light intensity on photoconduction in amorphous selenium films. D.Carles, G.Lefrancois, C.Vautier (LECAP, Faculte des Sci., Monte-Saint-Aignan, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.327-30 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Photoconductivity measurements of amorphous selenium are made on thin films prepared in ultra high vacuum conditions. The variations of the photocurrent I_{ph} versus light intensity F are given by $I_{ph} \sim F^x$ $(0.5 < x \leq 1)$. The experimental data show that x is a decreasing function of the sample thickness. The variations of x are interpreted in terms of diffusion of photoinduced defects. (8 refs.)

67683 A model for photovoltaic centres in ferroelectrics. V.V.Obukhovskii, A.V.Stoyanov.
Kvantovaya Elektron., Kiev (USSR), no.23, p.90-8 (1982). In Russian.
A model of an impurity complex responsible for a bulk photovoltaic effect in ferroelectrics is established. It is proposed that the complex comprises a deep attracting centre and, at some distance from it along the optic axis, a repelling Coulomb centre. Absorption and photovoltaic currents associated with the complexes are discussed. The maximum magnitude of the current is two orders higher than for the case of insulated impurity centres possessing dipole moments. (26 refs.)

67684 Absorption and photoconductivity of In_2Se_3 and Ga_2Te_3. P.Becla, Z.Gumienny, J.Misiewicz, J.M.Pawlikowski (Inst. of Phys., Tech. Univ. of Wroclaw, Wroclaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.143-9 (1982).
Absorption measurements of two III-VI compounds In_2Se_3 and Ga_2Te_3 have been made in the temperature range of 5-300K in the vicinity of their fundamental absorption edges. The energy positions of the absorption edge have been estimated; $E_g(300K) = 1.36$ eV, $E_g(80K) = 1.52$ eV and $E_g(5K) = 1.56$ eV for In_2Se_3, and $E_g(300K) = 1.2$ eV for Ga_2Te_3. Spectral characteristics of photoresponses in the photoconductivity mode have been investigated in the temperature range 80-300K, and near and above the fundamental absorption edges of both semiconductors. The shape of photoresponse characteristics, the detection parameters and possible applications of these materials in the range of infrared and visible radiation are discussed. (6 refs.)

67685 Photomagnetoresistance $Cd_{1-x}Mn_xTe$. M.Lindstrom, P.Kuivalainen, J.Heleskivi (Electron Phys. Lab., Helsinki Univ. of Technol., Helsinki, Finland), R.R.Galazka.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.479-81 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Photoconductivity and photomagnetoresistance (PMR) measurements on $Cd_{1-x}Mn_xTe$ single crystals for x=0.05, 0.30 and 0.50 have been carried out in the temperature range 4.2-200K in magnetic fields up to 10 T. PMR is very large and changes from positive to negative with increasing x. Various mechanisms which could account for the observed PMR are considered. It is concluded that the magnetic field dependent recombination of photocarriers causes a significant contribution especially at low Mn-concentrations. (13 refs.)

67686 The effects of band bending on the photoconductivity in a-SiL:H. W.B.Jackson, M.J.Thompson (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.883-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The effects of band bending on photoconductivity in hydrogenated amorphous silicon were systematically investigated by measuring the photoconductivity on field effect transistors as a function of the applied gate voltage. The intensity and the spectral dependence of the photoconductivity showed large changes due to band bending. The results suggest that much of the conflicting photoconductivity results are due to band bending. There is some evidence for depleting interface gap states by band bending. (7 refs.)

67687 Recombination effects on transient photocurrent in a-Si:H. N.Matsumoto, T.Kagawa, S.Furukawa (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.929-31 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Temperature and illumination pulse width effects on transient photocurrent in nondoped and nitrogen doped a-Si:H were measured. The photocurrent exhibits a power law decay in the form of $t^{-\beta}$ and log i-log t plot shifts towards the short time region as illumination pulse width decreases. β depends not only on gap state density profile but also on recombination rate. They are interpreted using a new multiple trapping model considering the recombination process and the illumination pulse width. (11 refs.)

67688 New calculations of the quantum yield of silicon in the near ultraviolet. J.Geist (NBS, Washington, DC, USA), C.S.Wang.
Phys. Rev. B (USA), vol.27, no.8, p.4841-7 (15 April 1983).
The rigorous expression for the quantum yield for electron-hole pair production was simplified using assumptions inspired by Kane's (1967) random-*k* approximation and by recent results of Alig, Bloom, and Struck (1980). The resulting approximation was intuitively satisfying. It required integration with respect to kinetic energy of the product of the joint distribution of the photongenerated electrons and holes and the average number of electron-hole pairs created by the cascade of impact ionizations initiated by a carrier with a given kinetic energy. The first quantity in the integrand was calculated from a self-consistent, first-principles band structure for silicon; the second was obtained from results of Alig, Bloom, and Struck. The results agreed reasonably well with recent experimental measurements of the quantum yield of silicon in the ultraviolet. (14 refs.)

67689 Amorphous silicon-carbon-fluorine alloy films. R.Dutta, P.K.Banerjee, S.S.Mitra (Dept. of Electrical Engng., Univ. of Rhode Island, Kingston, RI, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5032-8 (15 April 1983).
A new amorphous semiconductor alloy system $Si_xC_xF_y$ has been prepared by RF sputtering of polycrystalline SiC in an $Ar+SiF_4$ atmosphere. Dark conductivity and optical absorption of thin films are measured as functions of F concentration. Infrared spectra indicate a preferential attachment of fluorine to carbon over silicon. The bonded fluorine concentration is estimated to be as high as 40 at.%. The principal reststrahlen band shifts to higher frequencies and appears to sharpen with the increase of fluorine concentration. Fluorinated films are observed to be resistant to high-temperature annealing. (18 refs.)

67690 Transport parameters of partially illuminated semiconductors. G.J.Papaioannou, P.C.Euthymiou, M.J.Papastamatiou (Univ. of Athens, Athens, Greece).
Solid State Commun. (USA), vol.46, no.2, p.165-7 (April 1983).
The use of experimental data for the definition of transport parameters of semiconductors is directly possible when the excess carriers are much less numerous than the thermal equilibrium ones. When this assumption is not fulfilled the data from photo-Hall effect and photoconductivity are average values with relative errors, which in some cases are larger than 30%. By considering the specimen as consisting of two regions—with and without excess carriers—a more accurate definition of these effects is possible; it leads to a better approximation of the real photoelectronic data and, hence, an improved disruption of the semiconductor material. (7 refs.)

67691 Residual conductivity in $GdIn_3S_6$ crystals. G.M.Guseinov, G.M.Niftiyev, M.G.Shakhtakhtinsky (Inst. of Phys., Acad. of Sci., Baku, Azerbaijan SSR).
Solid State Commun. (USA), vol.46, no.2, p.171-5 (April 1983).
Deals with a study of the RC effect in single $GdIn_3S_6$, depending on temperature the electric field and the wavelength of the light. It was found that the multiplicity of the RC at 77K amounts 10^6, the multiplicity of the RC at decreases with increasing temperature at a temperature above 250K the RC disappears and only lasting relaxations (LR) of photocurrent are observed. It was shown that at electric fields from 3.5×10^2 to 2×10^3 V cm^{-1} the value of the current RC state is almost the same as that of the photocurrent. Starting with 2×10^3 V cm^{-1} and above the value of the RC decreases, even though the photocurrent increases. Current voltage characteristics (CVC) in the RC state and the field quenching of RC have been studied. It is noted that the levels with location depths from 0.01 to 0.16 eV in the temperature range from 77 to 90K are responsible for the manifestation of the RC state. It was shown that the low values of trapping cross-sections of the traps with location depths from 0.01 to 0.16 eV, the existence of RC, the quenching of RC by an electric field and the *N*-like CVC, observed in the crystals, are explained within the framework of a heterogeneous-semiconductor model. (11 refs.)

67692 Intraband photoconductivity in coloured amorphous WO_3 films and intervalence transfer model. V.Dallacasa, M.Manfredi, G.Schianchi (Istituto di Fisica, Univ. di Parma, Parma, Italy).
Solid State Commun. (USA), vol.46, no.7, p.561-3 (May 1983).
No photoconductivity has been found in the hopping levels in recent optical end electrical measurements in coloured amorphous WO_3 films. A simple theoretical analysis of the process in the framework of an intervalence-transfer model leads to the conclusion that this photoconductivity is, in fact, not to be expected at low and moderately high electric field values. (11 refs.)

67693 Kinetics of charging of copper impurity centers in Ge during strong laser excitation. Yu.Vaitkus, V.Grivitskas, L.Ionikas, S.K.Novoselov (V. Kapsukas State Univ., Vilnius, Lithuanian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1282-5 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR),* vol.16, no.11, p.1987-91 (Nov. 1982). [received: April 1983]
Investigations were made of the photoconductivity and of the pulse photo-Hall effect in Ge:Sb crystals compensated with Cu. Excitation with neodymium laser pulses caused complete charging of the Cu impurity levels as a result of unipolar capture of holes. An analysis of the relaxation kinetics of the mobility and photoconductivity was used to consider the processes of carrier scattering and recombination. It was found that the Hall mobility in the Δn, $\Delta p\geq3N_{Cu}$ case was due to the electron-hole scattering and hole drag. In the Δn, $\Delta p<3N_{Cu}$ case it was possible to determine separately the electron-capture coefficients of impurity centers characterized by different charge states. (21 refs.)

67694 Photoconduction in heavily doped compensated semiconductors. V.V.Osipov, M.G.Foigel' (Sci.-Res. Inst. of Phys., I.I. Mechnikov State Univ., Odessa, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1305-8 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR),* vol.16, no.11, p.2022-8 (Nov. 1982). [received: April 1983]
A theory is developed for intrinsic steady-state photoconduction in heavily doped compensated semiconductors having deep recombination levels. A consistent analysis is given of the effects of tunneling through random potential barriers by carriers near the mobility thresholds. It is shown that, at sufficiently low temperatures, tunneling plays the decisive part in recombination processes. This makes the recombination barriers much less than the drift barriers, and therefore the recombination time almost independent of the temperature, and the photoconductivity an exponentially increasing function of temperature. The expression obtained, taking account of tunneling, for the recombination rate via deep levels becomes at high temperatures the known expression for this quantity, an activation-type function of the temperature. In the latter case, the photoconductivity in the presence of deep compensating recombination centers or with a correlated impurity distribution depends linearly on the light intensity and decreases exponentially with rising temperature. (11 refs.)

67695 Transient photocurrent behavior in amorphous semiconductors. V.I.Arkhipov, A.I.Rudenko (Engng. Phys. Inst., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1336-7 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR),* vol.16, no.11, p.2068-70 (Nov. 1982). [received: April 1983]
There has recently been much study of transient photoconduction in amorphous semiconductors. An important feature of these processes is the decisive effect of carrier capture by localized states whose energies are distributed over a fairly wide range in the gap. The authors deal with the case of an exponential energy distribution of localised states, i.e. assume that the number of such states per unit volume in the energy range from $\mathcal{E}$ to $\mathcal{E}+d\mathcal{E}$ is $(N_t/\mathcal{E}_0)$ exp $(-\mathcal{E}/\mathcal{E}_0)d\mathcal{E}$. Such a distribution is known to be common in various amorphous materials. They assume that the bimolecular mechanism of recombination predominates. It is supposed that the carriers of one sign (electrons) are rapidly localized and therefore remain practically at rest, and that recombination occurs as a result of the motion of delocalized carriers of the other sign (holes). (5 refs.)

67696 Gaussian nature of the dispersion in the transport of carriers in glassy As_2Se_3. L.P.Kazakova, E.A.Lebedev, E.A.Smorgonskaya (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1342-4 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR),* vol.16, no.11, p.2077-80 (Nov. 1982). [received: April 1983]
A detailed investigation was carried out on the nature of carrier dispersion in glassy As_2Se_3 by undertaking investigations of the transport processes in bulk samples prepared directly from a glass ingot by mechanical treatment. the experiments were carried out by measuring the transit time of carriers across a sample. The electric field in the samples was $(0.5\text{-}3)\times10^5$ V/cm and the thickness of the samples was within the range 30-70 μm. A semitransparent gold film was used as the upper electrode. An excess carrier density was created near this electrode by laser radiation. A transient photocurrent pulse was recorded on an oscillograph screen and the shape of this pulse corresponded to a continuous fall of the photocurrent with time. (11 refs.)

67697 Photovoltaic effect due to scattering by charged point defects in ferroelectrics. A.S.Sidorkin, A.P.Lazarev, T.N.Krasova (Lenin Komsomol State Univ., Voronezh, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1617-18 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR),* vol.24, no.9, p.2851-3 (Sept. 1982). [received: April 1983]
The authors determine the coordinate dependence of the potential of charged point defects in the polar phase of a ferroelectric and evaluate the photovoltaic current due to scattering of the carriers by defects of this type. It is assumed that the photoexcitation of electrons into the conduction band is a result of impurity-band transitions. (4 refs.)

67698 Photoconductivity instability in thin polycrystalline CdS layers with high surface-charge density. S.A.Korepanov, P.A.Viktor, V.V.Serdyuk (I.I. Mechnikov Odessa State Univ., Odessa, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.594-7 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR),* vol.25, no.7, p.18-22 (July 1982). [received: May 1983]
The instability of the photocurrent in thin CdS films prepared by the electrohydrodynamic sputtering method is investigated. The degradation of photosensitivity of the films during the prolonged illumination and the restoration of their photosensitivity in dark are explained by assuming the drift of ionized lattice defects in the field set up by negatively charged oxygen adsorbed on the surface of the crystallites. The spatial distribution of the potential in a crystallite is calculated, demonstrating a substantial change in the height and profile of the intercrystallite barriers as a result of the drift of defects. (12 refs.)

67699 Grain boundaries and intragrain defects dependence of local and global electronic and photovoltaic properties of CGE polysilicon. J.Oualid, M.Zehaf, H.Amzil, J.P.Crest, G.Mathian, J.Dugas, J.Gervais, F.Minari, B.Pichaud, S.Martinuzzi (Faculte des Sci. et Tech. de Saint-Jerome, Univ. d'Aix-Marseille III, Marseille, France), J.Fally.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.421-6
Minority carrier properties (L_n, τ_n, μ_n) and photovoltaic parameters (I_{sc}, V_{oc}) have been measured in small MESA diodes revealed in N^+P photocells cut out from different regions of polysilicon ingots (top, middle, bottom or periphery, centre). Their dependence on the physical properties (number of grains N_G per diode, dislocations, impurities) has been analysed. It has been shown that the electronic and photovoltaic properties decrease strongly when the number of grains per diode N_G increases. This influence of the grain size is often screened by intragrain defects. The dispersion of the results can be partially resolved by taking into account the dislocation distribution. Local measurements of photocurrents I_{ph} and diffusion lengths L_n performed with a 5 μm light spot confirm the influence of dislocations on the grain respose. (13 refs.)

Spectroscopic search for fractional charge in ultrapure semiconductors .... See Entry 65199

Structure and photoelectric properties of films of solid solutions of the system $Na(K)SbS_2$-Sb_2S_3 .... See Entry 67393

Amorphous to microcrystalline transitions in Si films .... See Entry 67403

Anomalous composition and temperature dependence of the energy gap of $AgGa_{1-x}In_xSe_2$ mixed crystals .... See Entry 67446

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Physical properties of the deep X electron trap responsible for long time persistent photocapacitance in CdS .... See Entry 67519

Energy shift of hydrogenic donors in a magnetic field due to electric and strain fields .... See Entry 67530

Optical properties of deep centers in semi-insulating ZnSe .... See Entry 67539

Estimation methods for localized-state distribution profiles in undoped and phosphorous-doped *a*-Si:H .... See Entry 67543

Studies of the gap states density in undoped and doped amorphous hydrogenated silicon .... See Entry 67545

Peculiarities of the residual conductivity in photoconductor-dielectric materials based on cadmium sulfide .... See Entry 67591

Delocalization of H^--like impurity states and formation of band type impurity conductivity in semiconductors .... See Entry 67604

Theory of relaxation of hot electrons and oscillatory photoconductivity in polar semiconductors .... See Entry 67626

Impact ionization probability and photo quantum efficiency in InSb .... See Entry 67627

Carrier dynamics in optically illuminated a-Si:H .... See Entry 67641

Energy dependence of the carrier mobility-lifetime product in hydrogenated amorphous silicon .... See Entry 67645

Validity of the effective lifetime concept in polycrystalline silicon .... See Entry 67648

Surface photo-EMF in mercury-doped germanium at high optical excitation rates .... See Entry 67747

Charge carrier escape rate from electrode-liquid interface .... See Entry 67754

Preparation and properties of *n*-Si-*n*-ZnO heterostructures .... See Entry 67773

Measurements of depletion layers in hydrogenated amorphous silicon .... See Entry 67784

Determination of semiconductor quasi-Fermi level separation under illumination .... See Entry 67787

Modulation of the electrical conductance of phthalocyanine films by circularly polarized light .... See Entry 67821

Injection-stimulated blackening of As_2Se_3 films ....See Entry 67823

Influence of light exposure on the transport properties of a-Si:H films ....See Entry 67824

Cyclotron resonance and impurity absorption in tellurium under pressure in the submillimeter range ....See Entry 68029

Incorporation scheme of H reducing defects in a-Si studied by NMR and ESR ....See Entry 68050

Direct observation of ferroelectric phase in $Pb_{1-x}Sn_xTe$ ....See Entry 68134

Current state of a semiconductor in the field of a strong electromagnetic wave ....See Entry 68165

Initial stage in the redistribution of photoinduced charges and electric fields in $Bi_{12}SiO_{20}$ ....See Entry 68177

Laser-induced magneto-optical transitions from deep levels in n-InSb ....See Entry 68180

The contribution of the Staebler-Wronski effect to gap-state absorption in hydrogenated amorphous silicon ....See Entry 68261

Far-infrared magneto-dynamics of photoexcited electron system in gallium arsenide ....See Entry 68277

Luminescence, transient transport and photoconductivity in chalcogenide glasses ....See Entry 68315

Absorption in hydrogenated amorphous silicon at energies less than the optical band gap ....See Entry 68349

Effect of various plasmas on vacuum deposited amorphous and microcrystal silicon ....See Entry 68441

Deposition and properties of zinc phosphide films ....See Entry 68454

Study of the grain boundary effects in N-P junction polycrystalline Si solar cells ....See Entry 68888

72.50 ACOUSTOELECTRIC EFFECTS

67700 Phonon echoes in piezoceramic lead-zirconate titanate. R.M.Holt, J.O.Fossum (Electronics Res. Lab., Norwegian Inst. of Technol., Trondheim, Norway).
Appl. Phys. Lett. (USA), vol.42, no.9, p.787-9 (1 May 1983).
Two-pulses phonon echoes have been generated in piezoceramic lead-zirconate-titanate, using an electric field at twice the frequency of the ultrasonic waves. The echo properties with respect to pulse width, electric field, frequency, and temperature dependences have been studied. It is demonstrated how the phonon echo can be utilized in sorting the pure sound absorption from the grain scattering losses in a ceramic material. (12 refs.)

67701 Evolution of the spectrum of a signal during multitransit generation of acoustic waves in piezoelectric semiconductors. G.D.Mansfel'd, A.A.Rubtsov (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1295-7 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2007-10 (Nov. 1982). [received: April 1983]
A study was made of the process of formation of the spectrum of acoustic waves by multitransit generation in an alternating electric field applied to *n*-type InSb crystals at liquid nitrogen temperature. During the initial stage the spectrum was due to a nonlinear non-Peierls interaction of amplified fluctuations and narrowing of the spectrum occurred at a constant integrated intensity of these fluctuations. After a large number of transits the spectrum of the generated waves consisted of narrow lines and its subsequent evolution was governed by the self-interaction of acoustic waves. (10 refs.)

Influence of a static electric field on the properties of Love surface waves in class 622 and 422 piezoelectric crystals ....See Entry 67332

72.55 MAGNETOACOUSTIC EFFECTS

67702 The theory of the tilt-effect in metals with a complicated Fermi surface. A.V.Eremenko, E.A.Kaner.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.403-11 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
A theoretical study of the dependence of the high-frequency longitudinal sound absorption and velocity on the angle between the magnetic field and the propagation vector is presented in the collisionless limit. It is shown that the phase volume increases and the singularity in electron-phonon interaction intensifies in the case of the quadratic dependence of the longitudinal electron velocity on p_z. That leads to the nonanalytic dependence (the discontinuities) in the sound absorption and velocity. An analysis is presented for the strong and weak connection of electrons with the sound. (2 refs.)

Excitation of magnetoacoustic waves by two microwave beams in InSb ....See Entry 67673

72.60 MIXED CONDUCTIVITY AND CONDUCTIVITY TRANSITIONS

67703 Semiconductor-metal transition in $Bi_{0.8}Sb_{0.2}$ alloys under tension. N.B.Brandt, M.Yu.Lavrenyuk, N.Ya.Minina.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.392-7 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The semiconductor-metal transition in $Bi_{1-x}Sb_x(0.2 \leq x \leq 0.22)$ alloys under tension along the binary axis is observed. The transition is caused by overlapping of energy bands at *L* and *H* points of the Brillouin zone which is responsible for genesis of the energy spectrum of Sb. The arising Fermi surface and its variation with stress are investigated. (9 refs.)

67704 Metal-dielectric type transition in needle crystals of iodine and oxygen doped niobium-sulphur compounds. M.A.Obolenskii, V.I.Beletskii, D.D.Balla, Kh.B.Chashka.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.437-9 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Needle crystals of iodine and oxygen doped niobium-sulphur compounds were grown. Electrical resistance in temperature range 4.2-300K and current-voltage characteristic of crystals in the temperature range 4.2-5K were studied. Metal-dielectric type transition is found. In temperature range above R_{min} metallic conductivity $1nR \ll T$ is found. At temperatures below R_{min} semiconductor-type conductivity and nonlinear current-voltage characteristics are observed. (3 refs.)

67705 Effect of composition on the structure and electrical properties of As-Se-Cu glasses. M.M.Haifz, M.M.Ibrahim, M.Dongol (Phys. Dept., Assiut Univ., Assiut, Egypt).
J. Appl. Phys. (USA), vol.54, no.4, p.1950-4 (April 1983).
As-Se-Cu glasses, with Cu content varying between 5 and 25 at.%, were produced by quenching from the melt. The values of resistivity and activation energy for conduction decreased continuously with increasing the copper content. Memory switching phenomena was observed in glasses containing Cu less than 20 at.%. Glasses containing higher Cu concentration showed a reverse switching cycle. Thermally induced changes in the structural properties have been examined using X-ray diffraction, differential thermal analysis, and scanning electron microscopy. The results were discussed on the basis of thermally induced transformations. (15 refs.)

67706 Effect of Al electrodes on DC and AC current-voltage characteristics of chalcogenide glass films. T.Takeda (Dept. of Electronics, Tokai Univ., Fukuoka, Japan), G.Nogami.
J. Appl. Phys. (USA), vol.54, no.4, p.2119-20 (April 1983).
DC current-voltage (*I-V*) characteristics and AC switching phenomena have been investigated in amorphous semiconductor films of $Si_{12}Te_{48}As_{30}Ge_{10}$ (STAG) sandwiched between evaporated electrodes of Al and Au on an insulating glass substrate. The results show that Al and Au do not form rectifying contacts to STAG. When oxidized Al is used as an electrode an anomaly is observed in both DC and AC characteristics. (8 refs.)

67707 Electronic transition under pressure in the two-dimensional purple bronze $K_{0.9}Mo_6O_{17}$. J.Dumas, C.Escribe-Filippini, J.Marcus, J.Mercier, D.Salomon, C.Schlenker (Groupe des Transitions de Phases, CNRS, Grenoble, France), F.Razavi.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.602-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electrical resistivity of $K_{0.9}Mo_6O_{17}$ has been measured between 2K and 300K under pressures up to 1.2 GPa. At low pressures, the temperature of the onset of the CDW is decreased by the pressure. Below 20K, the resistivity rises with decreasing temperature, indicating a semiconducting type behaviour. (13 refs.)

67708 Transport and structural properties of the silver intercalation complexes of $2H\text{-}TaS_2$. G.S.Boebinger, N.I.F.Wakefield, E.A.Marseglia, R.H.Friend (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.608-10 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reports the transport and structural properties of the intercalation complex of $2H\text{-}TaS_2$ formed by electrochemical intercalation of Ag^+ from aqueous solution, of stoichiometry $Ag_{0.65}TaS_2$. The temperature dependent resistivity shows three anomalies, at 190K, 140K and 96K. X-ray measurements of the unit cell parameters indicate that there are structural changes at the upper and lower transitions. Electron diffraction shows the appearance of a superlattice with a doubled in-plane cell constant below the 190K transition. These results are discussed in terms of possible ordering of the Ag ions. (11 refs.)

67709 Metal-nonmetal transition and superconductivity in amorphous $Si_{1-x}Au_x$ system. M.Yamaguchi, N.Nishida, T.Furubayashi, K.Morigaki, H.Ishimoto, K.Ono (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.694-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The metal-nonmetal transition in the amorphous $Si_{1-x}Au_x$ system has been investigated as a function of Au content, x, at temperatures down to 10 mK. The log T and $\sqrt{T}$ dependences of electrical conductivity have been observed in a certain temperature range, depending on x. The results are discussed in terms of localization and electron interactions. Superconductivity has been found for samples with a certain range of x whose superconducting transition temperature depends on x, i.e. 0.1K for x=18.5 at.% and 0.7K for x=35 at.%. (17 refs.)

67710 Loss of dimensionality, localisation and conductance oscillations in n-type GaAs FETs. D.A.Poole (Cavendish Lab., Univ. of Cambridge, Cambridge, England), M.Pepper, H.W.Myron.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.697-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Presents new results for the transition from 3 dimensional (3D) conduction to 2D conduction in a GaAs FET. By applying a magnetic field, B, it is possible to observe 2 metal-insulator transitions at low temperatures by (a) suppression of weak localisation at low B returning the system to metallic conduction and (b) shrinking of the donor wavefunctions at high B localising states at the Fermi energy. Magnetoresistance has been measured over 4 decades of B and for temperatures between 4.2 and 1.2K, the results being in satisfactory agreement with current theories of localisation in 2D and 3D. The authors also present new conclusions for the anomalous oscillations in conductance with applied gate bias observed in most GaAs FETs at low temperatures. The strength of the oscillations is related to the quality of the FET, being predominant in commercial microwave GaAs FETs. (10 refs.)

67711 A thermophonic investigation of switching and memory phenomena in thick amorphous chalcogenide films. J.Kotz, M.P.Shaw (Dept. of Electrical & Computer Engng., Wayne State Univ., Detroit, MI, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.986-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reports the results of thermophonic experiments and numerical analyses of bias-induced threshold switching and memory effects in amorphous films of $Ge_{15}Te_{81}S_2Sb_2$. The results show that the initiation and maintenance of a threshold switching event are fundamentally electronic processes. (24 refs.)

67712 Model of a low-resistivity state formed as a result of nanosecond electric switching in amorphous semiconductor films. S.Balyavichyus, V.Gruzhinskis, A.Poshkus (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, Lithuanian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1248-51 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1934-7 (Nov. 1982). [received: April 1983]
An investigation was made of the current-voltage characteristics of a low-resistivity state formed a few nanoseconds after monostable electric switching in amorphous films of the $In_{0.25}Te_{0.75}$ composition. It was found that a typical current-voltage characteristic had a linear section which passed through the coordinate origin when extrapolated. The resistance of the low-resistivity state deduced from the slope of this section decreased on increase in the switching voltage and on increase of the thickness of the active material. A model was developed to explain the experimental results and this allowed for the complex topology of the low-resistivity region. The theory agreed with the experimental results on the assumption that the high-conductivity part of the semicon-

ductor was a structure of the Bethe-lattice type with a coordination number of 3. (12 refs.)

Energy gap dependance of the acceptor ionization energy induced by hydrostatic pressure at low temperature, near the SM-SC transition on $Hg_{1-x}Cd_xTe$ .... See Entry 67443

Separable spectral model of the metal-insulator transition in Si:P .... See Entry 67455

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72.80 CONDUCTIVITY OF SPECIFIC SEMICONDUCTORS AND INSULATORS

(see also 81.40R Electrical and magnetic properties related to materials treatment)

72.80C Elemental semiconductors

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Studies of the gap states density in undoped and doped amorphous hydrogenated silicon .... See Entry 67545

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Luminescence, transient transport and photoconductivity in chalcogenide glasses ... See Entry 68315

Effect of various plasmas on vacuum deposited amorphous and microcrystal silicon ... See Entry 68441

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition ... See Entry 68448

72.80P Liquid semiconductors

Investigation of the Hall effect in liquid gallium antimonide near the melting point ... See Entry 67660

72.90 OTHER TOPICS IN ELECTRONIC TRANSPORT IN CONDENSED MATTER

67713 **Effect of the particle sizes of the components on the leakage threshold of the electrical conductivity of a dispersed mixture.** L.A.Bel'kova, E.A.Zamotrinskaya, V.V.Zagoskin, T.G.Mikhailova, V.M.Nesterov (V.D. Kuznetsov Physicotech. Inst., Tomsk Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.585-9 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.10-14 (July 1982). [received: May 1983]
The electrical conductivity of a dispersed mixture of sand and graphite of various granulometric compositions (filling factor k=0.74) was investigated. It is shown that for mixtures which have pore sizes in a structure of dense packing of one component do not exceed the particle sizes of the other component and the threshold volume concentration of the conducting phase is completely determined by the ratio of the particle sizes of both phases. An analytic expression relating the volume threshold concentration of the con-

ducting component and the particle sizes of the components is obtained by solving the bond problem. (6 refs.)

73.00 ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS

73.20 ELECTRONIC SURFACE STATES

(for emission and impact phenomena, see 79.)

67714 The atomic structure and electronic states of $GaAs_{1-x}P_x$ (110). Xu Yong-Nian, Zhang Kai-Ming (Dept. of Phys., Fudan Univ., China).
Acta Phys. Sin. (China), vol.32, no.2, p.24-50 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The clean surface $GaAs_{1-x}P_x(110)$ has been studied by the EHT method using a cluster model. The authors obtained the following results: (1) the value of the rotated relaxation angle is about 26°. (2) For $x \geq 0.25$ the empty intrinsic cation states are found in the gap near the conduction band edge. (9 refs.)

67715 Study of metal-semiconductor interface states using Schottky capacitance spectroscopy. C.Barret, F.Chekir, A.Vapaille (Inst. d'Electronique Fondamentale, Univ. Paris-XI, Orsay, France).
J. Phys. C (GB), vol.16, no.12, p.2421-38 (30 April 1983).
In a forward-biased Schottky diode, the charge of the interface states can be electrically modulated. This results in the appearance of additional capacitance whose variations with frequency, bias and temperature can be used to determine the characteristic parameters of the states (energy position, density, capture cross sections). A simple model is described, taking into account any possible charge exchanges between the interface states and the three 'reservoirs' surrounding them (conduction and valence bands of the semiconductor and conduction band of the metal). Limit cases where one or two of these exchange paths are dominant are detailed and a few typical experimental examples are given. (18 refs.)

67716 Electronic structure and magnetism of surfaces and interfaces. A.J.Freeman (Dept. of Phys., Northwestern Univ., Evanston, IL, USA).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.31-6 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
Spurred by recent experimental advances, theoretical/computational methods for accurately determining the electronic structure and properties of surfaces and interfaces have been developed. This paper reviews the advanced state of local spin density determinations of the magnetic properties of free surfaces (e.g. Ni and Fe) and interfaces (e.g. Ni on Cu), using self-consistent spin-polarized energy band calculations of the energy dispersion and spatial character of surface and interface states. (32 refs.)

67717 Plasmons, intersubband resonance and localization in inversion layers with periodically structured gate electrodes. E.Batke, D.Heitmann, E.G.Mohr (Inst. fur Angewandte Phys., Univ. Hamburg, Hamburg, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.643-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Excitation of plasmons and intersubband resonance has been investigated in electron inversion layers of p-Si(100) and (111) with periodically structured gates. For high electron densities $N_s \gtrsim 6\times10^{12}$ cm^{-2}, a significant increase of the plasmon mass m_p has been found for Si(100), whereas m_p remains constant for the same densities on Si(111). Experiments with floating periodical gates indicate an anisotropic two-dimensional conductivity and localization effects. (13 refs.)

67718 Theory of semiconductor surface reconstruction: Si(111)-7×7, Si(111)-2×1, and GaAs(110). K.C.Pandey (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.761-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The author shows that minimization of the number of broken bonds present at the surface and a π-like bonding between the broken bonds are apparently the two keys to understanding several long-standing puzzles concerning Si surfaces. To fully exploit the above mechanisms, for both the π-bonding and elimination of broken bonds, the surface atoms must rearrange themselves rather thoroughly—namely, the surface topology and the ring structure must be altered. Based only on topological considerations and simple counting of broken bonds, the minimization of the number of broken bonds shows: why the 7×7 surface is terraced, i.e. consists of intersecting steps; why these steps (as well as steps on the cleaved surface) form only in certain crystallographic directions; why the terraces are triangular and not hexagonal; why the surface structure is symmetric 7×7 (as opposed to, e.g. 5×9); and what is the origin of the spatial scale of the 7×7 reconstruction. Of the reconstruction models proposed for the cleaved 2×1 surface, the π-bonding model leads to thelargest total-energy benefit, and only the π-bonding model provides a natural interpretation of the various spectroscopic data on this surface. The author shows that one of the most widely used ideas in the context of semiconductor reconstruction, that of buckling, is inappropriate for homopolar semiconductors. Buckling, however, provides a valid reconstruction mechanism for heteropolar surfaces such as the GaAs(110). These conclusions are based on total-energy and surface-band calculations using the self-consistent pseudopotential method. (16 refs.)

67719 Electronic structure and geometry of group IV semiconductor surfaces. F.J.Himpsel (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.767-70 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Photoemission results for the electronic structure of group IV semiconductor surfaces (C, Si, Ge) are critically reviewed and implications on the surface geometry are discussed. Data are presented for surface states and for core level shifts of surface atoms. (20 refs.)

67720 On the electronic structure of the Si(100)-2×1 surface. J.Pollmann, A.Mazur (Inst. fur Phys., Univ. Dortmund, Dortmund, Germany), M.Schmeits.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.771-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have investigated the electronic structure of the asymmetric dimer model for the Si(100)-2×1 surface using our tight binding scattering theoretical method for semiinfinite crystals on the basis of a realistic bulk Si description. Their results are in good agreement with all available UPS and ARUPS data resolving outstanding discrepancies between previous theoretical results and experiment and they lend strong further support to the asymmetric dimer model proposed by Chadi (1980). (15 refs.)

67721 Pseudopotential total energy calculations for Si(111)-(1×1) and Si(111)-(2×1). J.E.Northrup, M.L.Cohen (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.774-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The total energies of several models of the Si(111) surface have been calculated with the pseudopotential method and the local spin density functional formalism. The 2×1 chain model has the lowest calculated total energy of those structures considered. The energy of the relaxed 1×1 geometry is minimized when the electrons in the surface states have their spins ordered with a 2×1 antiferromagnetic symmetry. Such a surface may exist on laser annealed Si(111)-(1×1). (19 refs.)

67722 Charge- and spin-density wave instabilities on ideal semiconductor surfaces. A.Muramatsu, W.Hanke (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.781-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A microscopic theory of surface elementary excitations is presented, with particular emphasis on semiconductors. Within the framework of this formalism the authors study the conditions for the appearance of electronic (charge- and spin-density wave) instabilities at surfaces. Quantitative calculations for a Si(111) slab, based on a self-consistent pseudopotential band structure, display a pronounced effect of the excitonic (electron-hole) and RPA local-field many-body interactions. Their results show that the ideal paramagnetic surface is unstable with respect to SDWs with wave vectors nearly corresponding to (2×1) and (7×7) superstructures. This is in accordance with recent total energy calculations based on local spin-density pseudopotentials. (7 refs.)

67723 The diamond (111) surface: a dilemma resolved. B.B.Pate (Stanford Electronics Labs., Stanford, CA, USA), B.J.Waclawski, P.M.Stefan, C.Binns, T.Ohta, M.H.Hecht, P.J.Jupiter, M.L.Shek, D.T.Pierce, N.Swanson, R.J.Celotta, G.Rossi, I.Lindau, W.E.Spicer.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.783-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A dilemma due to the experimental observation of a 'clean' unreconstructed elemental semiconductor surface without band gap states is resolved. Results from photon stimulated ion desorption, high resolution low energy electron loss spectroscopy and photoemission spectroscopy find that the conventionally polished (in olive oil) diamond (111)1×1 surface is atomically terminated and electronically stabilized by hydrogen. Thermal desorption of hydrogen upon heating (~1000°C) results in a reconstructed 2×2/2×1 surface with filled electronic surface states in and near the fundamental gap. Exposure of the reconstructed surface to atomic hydrogen (or deuterium) is found to again terminate the surface and remove the near band gap surface states. Apparent inconsistencies (with respect to the experimental literature) in the understanding of the diamond:hydrogen interaction are resolved in terms of our work. (15 refs.)

67724 Intensity anomalies of Auger electron signals observed by incident beam rocking method for Si(111)7×7 and Si(111)$\sqrt{3}\times\sqrt{3}$Ag surfaces. Y.Horio, A.Ichimiya (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.792-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Auger electron signal intensities of Si(LVV) from clean surface and Si(LVV) and Ag(MNN) from $\sqrt{3}\times\sqrt{3}$ Ag surface are measured for various incident angles in [112] orientation of 10 kV electron incidence. RHEED pattern is simultaneously observed during the measurement of the Auger electron signal intensities. Enhancements of Si(LVV) from the clean surface are observed in the surface wave resonance (SWR) conditions due to the 7×7 surface structure. The enhancements are reduced by deposition of silver on clean surface and by constructing the $\sqrt{3}\times\sqrt{3}$ structure. Enhancements of Ag(MNN) from $\sqrt{3}\times\sqrt{3}$Ag surface are observed at the SWR condition due to $\sqrt{3}\times\sqrt{3}$ structure. At the angles of the SWR condition due to $\sqrt{3}$ structure, Si(LVV) signal intensity is not enhanced. (2 refs.)

67725 Theoretical study of the As(100) surface reconstruction of GaAs. D.J.Chadi, J.Ihm, C.Tanner (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), J.D.Joannopoulos.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.798-800 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The reconstruction of the As-terminated GaAs(100) surface was examined using both the tight-binding and the self-consistent pseudopotential methods. Dimer models with unit cells as large as the c-4×4 one seen in electron-diffraction experiments were tested. Unlike the Si(100) surface, symmetric as well as asymmetric dimers are predicted to occur in equal densities at the surface. (20 refs.)

67726 Electronic and vibronic excitations of semiconductor surfaces studied by electron energy loss spectroscopy. H.Luth (Phys. Inst., Rheinisch-Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.810-15 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Different types of excitations which can be studied by high resolution electron energy loss spectroscopy (HRELS) on semiconductor surfaces are discussed: surface phonons, surface plasmons, electronic interband transitions and vibrations of adsorbed molecules. As examples for the main classes of semiconductors results on Si, GaAs, InSb and ZnO surfaces are reported. (25 refs.)

67727 Electron states at abrupt metal-GaAs(110) interfaces. D.Bolmont, P.Chen, V.Mercier, C.A.Sebenne (Lab. de Univ. Phys. des Solides, Pierre et Marie Curie, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.816-18 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The electronic properties of forming metal/GaAs(110) interfaces (M=Ag, Cu, Ga, In), determined from photoemission yield spectroscopy are compared and discussed. They are governed by electron interface states associated with (i) the restructured semiconductor surface unbonded atoms (ii) the formation of bonds between the metal atoms and the atoms of the first GaAs layer. Although the systems form with different atomic arrangements at the interface, the Schottky barrier depends only slightly on the metal. (7 refs.)

67728 Core-level photoemission studies of MBE-grown semiconductor surfaces. R.Ludeke (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), T.-C.Chiang, D.E.Eastman.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.819-21 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The photoemission spectra of Ga-3d, As-3d and Sb-4d core levels reveal a rich surface-derived substructure which is due to changes in the surface bonding environment and indicates one or more surface bonding sites per surface atom. Bulk and surface contributions have been separated and used to determine the stoichiometry of several GaAs(100) surfaces. (7 refs.)

67729 Core level binding energy shifts for reconstructed GaAs(001) surfaces. J.F.van der Veen, L.Smit (FOM-Inst. for Atomic & Molecular Phys., Amsterdam, Netherlands), P.K.Larsen, J.H.Neave.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.822-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
With the use of surface-sensitive photoemission spectroscopy 3d-core level binding energy shifts have been determined for surface atoms in reconstructed MBE-grown GaAs (001) surfaces. An analysis of As(3d) shifts suggests that the C(4×4) structure is produced by chemisorption of arsenic on the As-rich 2×4 reconstructed surface. (11 refs.)

67730 Surface effects on core electron binding energies of semiconductors. F.Bechstedt, R.Enderlein, D.Reichardt (Sektion Phys., Humboldt-Univ. zu Berlin, Berlin, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.825-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A method is developed for the calculation of surface-induced binding energy changes of core electrons and applied to silicon surfaces. Shifts of solid state potentials due to covalent and ionic charge transfer and of relaxation energies are regarded. Recent experimental results on Si2p core levels at 2×1 reconstructed (111) and (100) surfaces can be partially reproduced. (8 refs.)

67731 Theory of amplification and instabilities of surface polaritons in semiconductors. R.F.Wallis (Phys. Dept., Univ. of California, Irvine, CA, USA), B.G.Martin, J.J.Quinn.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.828-30 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Under suitable conditions, surface polaritons may propagate along the surface of a semiconductor containing free carriers. If a DC electric field is applied so that a drift current flows parallel to the surface, instabilities of the surface polaritons may arise. A theoretical investigation has been made of such instabilities for the case of a planar surface of n-silicon with the current parallel or antiparallel to the propagation direction of the surface polariton. Surface polariton modes having a growing wave character were found for both a silicon-vacuum interface and a silicon-dissipative medium interface. (4 refs.)

67732 The interaction of hydrogen with surface states on GaAs(100). R.D.Bringans (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), R.Z.Bachrach.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.854-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The results of a photoemission study of hydrogen chemisorption on the GaAs(100) surface are presented. Clean (100) surfaces with a range of reconstructions were prepared by molecular beam epitaxy and in all cases the same surface structure resulted from exposure to atomic hydrogen. Angle resolved photoemission measurements revealed a hydrogen induced state at between 4.3 and 5.2 eV below the top of the valence band. The dispersion of this state in the surface Brillouin zone is discussed. (8 refs.)

67733 Observation of nonuniform energy band shifts for Ge on GaAs(100). P.Zurcher, J.Anderson, D.Frankel, G.J.Lapeyre (Dept. of Phys., Montana State Univ., Bozeman, MT, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.857-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Fractional monolayer studies of Ge on GaAs(110) were performed with angle-resolved photoemission at the Wisconsin Synchrotron Radiation Center. Normal emission data for $14<h\nu<27$ eV were analyzed. The most significant effects of the Ge adatoms are shifts in photoemission peaks known to be due to GaAs interband transitions. The shifts, which are nonuniform, are due to specific nonuniform shifts in interband transitions. Valence band (VB) shifts relative to the VB maximum can be determined from some of the transitions. The top VB shifts downward and the next deeper VB shifts upward in the neighborhood of one-third the distance from Γ to X on the Σ line (0.57 $Å^{-1}$). The authors suggest the shifts are the result of chemisorption-induced charge transfers whose resonance-like states decay over several atomic layers below the surface. (9 refs.)

67734 Two-dimensional Wigner lattice in a magnetic field and in the presence of a random array of pinning centers. A.G.Eguiluz, A.A.Maradudin (Dept. of Phys., Univ. of California, Irvine, CA, USA), R.J.Elliott.
Phys. Rev. B (USA), vol.27, no.8, p.4933-45 (15 April 1983).
The authors consider a two-dimensional Wigner lattice in the presence of a static external magnetic field perpendicular to the lattice and a random array of pinning centers. The phonons of the electron lattice are treated in the harmonic approximation, and the random distribution of pinning centers is dealt with in the single-site coherent-potential approximation. They obtain the average phonon Green's function and from it the spectral density for the phonons of the electron lattice. The presence of the random array of pinning centers gives rise to a low-frequency gap in the phonon spectral density. Thus the (two-dimensional) mean-square displacement of an electron about its equilibrium lattice site is finite at finite temperatures. The magnitude of the low-frequency gap decreases as the strength of the magnetic field is increased. For sufficiently high fields the gap disappears, but the phonon spectral density vanishes sufficiently fast as $\omega \rightarrow O$ that the mean-square displacement remains finite at finite temperatures. The authors present detailed numerical results for the phonon spectral density and electron mean-square displacement, both at $T=0$K and at finite temperatures. Their results are analyzed from the point of view of the stability of the lattice to thermal fluctuations. They find that at low temperatures ($T\sim1$K) both the pinning centers and the magnetic field considerably enhance the localization of the electrons about their lattice sites, thus enhancing the stability of the lattice. At higher temperatures, the electron mean-square displacement depends very weakly on the strength of the magnetic field, and its value is then determined by the concentration and strength of the pinning centers. (26 refs.)

67735 Scattering-theoretical method for relaxed and reconstructed surfaces with applications to GaAs(110) and Si(100)-(2×1). M.Schmeits (Inst. de Phys., Univ. de Liege, Liege, Belgium), A.Mazur, J.Pollmann.
Phys. Rev. B (USA), vol.27, no.8, p.5012-31 (15 April 1983).
The tight-binding scattering-theoretical method for the calculation of electronic properties of relaxed and reconstructed surfaces is described in detail and applied to the relaxed GaAs(110) surface and the reconstructed Si(100)-(2×1) surface. For the underlying bulk electronic structure, the authors employ realistic empirical tight-binding Hamiltonians retaining first- and second-nearest-neighbor interactions. In their calculations they have used surface-structural models, proposed in the literature on the basis of total energy minimization calculations. These models are in good agreement with low-energy electron-diffraction data. Relaxation- and reconstruction-induced changes in the interaction matrix elements with interatomic distance d are taken into account by the d^{-2} scaling law, as proposed by Harrison. They discuss their results in terms of surface band structures and wave-vector—integrated as well as wave-vector—resolved layer densities of states. These theoretical data allow for a detailed discussion of the origin and physical nature of the surface-induced features. In particular, the effects of relaxation or reconstruction on the ideal surface electronic properties can transparently be analyzed in the framework of the current method. Comparison of their results with both angle-integrated and angle-resolved photoemission data shows very good agreement confirming the charge-transfer bond-angle relaxation model for GaAs(110) and the asymmetric dimer model for Si(100)-(2×1). (49 refs.)

67736 Study of the reconstructed GaAs(100) surface. J.Ihm, D.J.Chadi (Xerox Palo Alto Res. Center, Palo Alto, CA, USA), J.D.Joannopoulos.
Phys. Rev. B (USA), vol.27, no.8, p.5119-21 (15 April 1983).
The reconstruction of an As-terminated GaAs(100) surface has been studied using the self-consistent pseudopotential method. Total energies for the (1×1) ideal surface and the $c(2\times2)$ and $p(2\times2)$ reconstructed surfaces within the dimer model are compared. Unlike the WSi(100) surface, at least two inequivalent dimers are required to produce the semiconducting surface and stabilize the system. Important features in the density of states and the valence-charge distribution are presented. (21 refs.)

67737 Temperature dependence of surface electronic structure of Si(111) surface. T.Yokotsuka, S.Kono, S.Suzuki, T.Sagawa (Dept. of Phys., Tohoku Univ., Sendai, Japan).
Solid State Commun. (USA), vol.46, no.5, p.401-4 (May 1983).
Temperature dependence of angle-resolved ultraviolet photoelectron spectra has been obtained for Si(111) surface starting with a thermally quenched '1×1' surface and ending with a high temperatue '1×1' surface. It has been found that the surface state at 0.8 eV below the Fermi level exhibits degradation with the increase in temperature, which explains the difference of surface electronic structures between a quenched '1×1' surface and a high temperature '1×1' surface. Electron correlation effect in adangling-bond derived surface state is postulated as a cause for the phenomenon. (8 refs.)

67738 Electronic structure evolution of Pd overlayers on Cu. M.Pessa, O.Jylha (Dept. of Phys., Tampere Univ. of Technol., Tampere, Finland).
Solid State Commun. (USA), vol.46, no.5, p.419-22 (May 1983).
Initial formation and subsequent development of the electronic structure in band-by-band detail are studied for epitaxial palladium overlayers deposited onto a copper (111) single crystal substrate. Two-dimensional Bloch states are found to be established at the first full monolayer. The three-dimensional Bloch states characteristics of the Pd bulk crystal begin to be observed upon completion of the second layer. A surface sensitive Pd-derived feature is found to be formed at coverages of two monolayers. (17 refs.)

67739 Electronic structure of the HCP phase of silver-aluminum alloys. U.O.Karlsson, G.V.Hansson, S.A.Flodstrom (Dept. of Phys. & Measurement Technol., Linkoping Inst. of Technol., Linkoping, Sweden).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.58-65 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The close-packed (0001) surface of the ζ-phase of the Ag-Al alloy has been studied with angle-resolved photoelectron spectroscopy. The ζ-phase was obtained by evaporating Ag onto an Al(111) crystal face and was verified by LEED. The polar angle dependence of the photoelectron emission was recorded along the two symmetry lines ΓM and ΓK of the surface Brillouin zone. The creation of the HCP lattice gives two new structures in the spectra. These structures are found around Γ and M in the surface Brillouin zone and are assigned to be emission from surface states located in band gaps induced by the HCP structure. The 4d band emission observed from the ζ-phase Ag-Al alloy is structureless and shows no similarity with the 4d band emission from Ag 4d in crystalline phase. (19 refs.)

67740 Surface core-level shifts at the end and beginning of the transition metal series. M.Erbudak, P.Kalt, L.Schlapbach, K.Bennemann (Lab. fur Festkorperphys., ETH, Zurich, Switzerland).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.101-4 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Surface core level shifts Δ_c^s of Au, Pd, Rh, Sc, and Ca have been measured by photoemission. (4 refs.)

67741 Core level shifts and valence change at the surface of intermetallic rare-earth systems. G.Kaindl, W.D.Schneider, C.Laubschat (Inst. fur Atom- und Festkorperphys., Freie, Univ. Berlin, Berlin, Germany), B.Reihl, N.Martensson.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.105-11 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Surface effects on valence and 4f as well as 5p binding energies of the dialuminides of the heavy rare earths (RE) including Lu were investigated by high-resolution photoemission using synchrotron radiation. For comparison, Eu, Yb, and Lu metal and $YbZn_2$ were also studied. A divalent surface layer was found for trivalent $SmAl_2$. A pronounced difference between trivalent and divalent (including mixed-valent) RE systems in the sensitivity of core-level binding energies to alloying was found and is discussed in terms of the valence-band structure of these solids. (18 refs.)

67742 Thermodynamic interpretation of core-level binding energies in adsorbates. D.Tomanek (Inst. fur Theoretische Phys., Freie Univ. Berlin, Berlin, Germany), P.A.Dowben, M.Grunze.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.112-19 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Using the 'equivalent cores' approximation in combination with a Born-Haber cycle the authors calculate core-level binding energies for adsorbates on metal surfaces. Since accurate thermodynamic data are required for the molecule both in the initial and in the final state, they restrict the discussion to adsorbed carbon monoxide, surface species that contain nitrogen and the halogens bromine and iodine. Reasonable agreement between theoretical and experimental values is achieved for adsorbates for which the adsorption energies are accurately known and complete final state screening for the adsorbate is expected. (32 refs.)

67743 Electronic excitations in K monolayer adsorbed on Si(100) 2×1. H.Tochihara (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.523-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
K adsorption on Si(100) 2×1 has been studied by using angle-integrated electron energy loss spectroscopy, LEED, AES, $\Delta\phi$ and core-level excitations as a function of K coverage. At coverages of 0.25 the insulator-to-metal transition in the K overlayer is observed and the intensity of the overlayer plasmon starts to increase. The plasmon has a one-dimensional character from the standpoint of the structural model of adsorbed K. The energy loss of the plasmon decreases slowly to 1.8 eV. In the case where alkali atoms are adsorbed on metal surface, the energy loss of the plasmon increases with increasing coverage. The different behaviour is discussed based on the structure of adsorbed alkali atoms. (11 refs.)

67744 Electronic structure of bulk and surface vanadyl oxygen vacancies in the layer compound V_2O_5. W.Lambrecht, B.Djafari-Rouhani, J.Vennik (Lab. voor Kristallografie, Rijksuniv. Gent, Gent, Belgium).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.558-64 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The electronic structure of the vanadyl oxygen vacancy in V_2O_5 is studied by means of tight binding methods. The localized states and changes in density of states in the conduction band are calculated by means of a Green function method based on the band structure of a single layer. Atomic relaxation effects are studied by means of cluster models. An inward shift of vanadium into the oxygen layer is found to be energetically favourable. The effect of the relaxation on the localized states is small. Due to the layer structure of V_2O_5, bulk and surface vacancies are similar. (16 refs.)

67745 Surface recombination waves in semiconductors. A.I.Klimovskaya (Inst. of Semiconductors Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1329-31 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2058-61 (Nov. 1982). [received: April 1983]
Recombination waves can exist in a space charge layer, and in this case the surface states act as deep centers and the space charge field controls the fluxes of carriers reaching the surface states. The author considers the behavior of a small fluctuation in a surface space charge layer in a semiconductor. (5 refs.)

Electronic damping mechanism for vibrations, rotations, and translations of adsorbates on metal surfaces .... See Entry 67337

Chemisorption and electronic charge transfer at ionic semiconductor surfaces .... See Entry 67350

Aspects of chemisorption in partially ionic semiconductors .... See Entry 67351

GaAs (001)-*c*(4×4): a chemisorbed structure .... See Entry 67353

Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). I. TPD, $\Delta\phi$, and UPS studies .... See Entry 67363

Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). II. ELS and XPS studies .... See Entry 67364

Molecular orbital study of CO chemisorption on a Pt(111) surface in the presence of potassium .... See Entry 67365

Molecular orbital study on the interaction of Ni and Cu atoms with oxygen-containing organic ligands and its implication to adsorption .... See Entry 67374

Applications of surface polaritons for vibrational spectroscopic studies of thin and very thin films .... See Entry 67479

Ground state correlation in the two-dimensional polarized electron gas .... See Entry 67493

Study of impurity states in a *n-n* GaAs-AlGaAs heterojunction using cyclotron resonance and Shubnikov-de Haas experiments .... See Entry 67511

Ground-state energy of a D^- ion in two-dimensional semiconductors .... See Entry 67531

Low-field galvanomagnetic tensor components for electrons in bismuth .... See Entry 67650

Magnetoresistance of the 2-D impurity band in silicon inversion layers .... See Entry 67653

Electron localization and the quantized Hall resistance in silicon inversion layers .... See Entry 67658

The effects of band bending on the photoconductivity in a-SiL:H .... See Entry 67686

Stoichiometry effects on Schottky barrier and interface states in GaAs {001}/Al system .... See Entry 67750

GaAs Schottky diode barrier heights related to surface and interface states .... See Entry 67751

Intersubband plasmons of a semiconductor superlattice .... See Entry 67765

Nickel and copper on cleaved indium phosphide: structure, metallurgy and electronic properties .... See Entry 67778

Electronic states and Schottky barriers at Pd_2Si/Si(111) interfaces .... See Entry 67780

Electronic properties of gold-silicon (111) 7×7 interfaces .... See Entry 67781

1-D minigaps in the subband structure of inversion layers on p-InSb .... See Entry 67795

Observation of the second subband occupation in the *p*-type (111) Si inversion layer .... See Entry 67798

Influence of the state of the surface on the low-temperature luminescence spectra of strongly excited ZnTe crystals .... See Entry 68322

Auger electron spectroscopy of TiO_2:inter- and intra-atomic transitions connected with the valence band .... See Entry 68368

Auger lineshape analysis .... See Entry 68369

Low energy electronic and vibronic excitations of semiconductor surfaces .... See Entry 68377

Photoemission from MBE grown III-V surfaces and interfaces .... See Entry 68406

XPS and UPS study of Pb monolayers on polycrystalline Pd .... See Entry 68409

Valence level photoelectron spectroscopy of the oxygen and carbonate species on silver (110) .... See Entry 68410

73.25 SURFACE CONDUCTIVITY

67746 Surface impedance of thin plates during bilateral electromagnetic field excitation. O.V.Kirichenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.385-91 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
A theoretical study is presented of the surface impedance of metal plates in a surface-perpendicular magnetic field during symmetrical and antisymmetrical bilateral excitation of an electromagnetic field. The effect has been studied of surface scattering of charge carriers on the surface impedance behaviour in strong magnetic fields ($r \ll \delta$, r is the curvature radius of the electron path in a magnetic field, δ is the attenuation depth of the electromagnetic field), where the diffusive character of the reflection may result in concentration of the electric current near the sample boundaries within a depth of about r. The surface dissipation of conduction electrons is described by an integral boundary condition with an arbitrary dissipation indicatrix; possibilities to determine the functionals of the scattering indicatrix by considering the dependence of the surface impedance on the external magnetic field value are shown. (12 refs.)

67747 Surface photo-EMF in mercury-doped germanium at high optical excitation rates. E.A.Gorin.
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1344-5 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2080 (Nov. 1982). [received: April 1983]
An analysis of the magnitude and kinetics of the surface photo-EMF at high excess carrier densities made it possible to estimate the contributions of various mechanisms of the formation of the surface photo-EMF and of the influence of external factors on it. (10 refs.)

Surface recombination velocity in a silicon optical waveguide .... See Entry 66383

Electron structure and electrical conductivity of the interface in a semiconductor bicrystal .... See Entry 67582

Surface properties of tin dioxide single crystals .... See Entry 67753

Determination of the generation lifetime and surface generation velocity by voltage step method .... See Entry 67786

73.30 SURFACE DOUBLE LAYERS, SCHOTTKY BARRIERS, AND WORK FUNCTIONS

67748 A reevaluation of the meaning of capacitance plots for Schottky-barrier-type diodes. S.J.Fonash (Pennsylvania State Univ., University Park, PA, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1966-75 (April 1983).
Capacitance-voltage (*C-V*) data, in the form of $1/C^2$ versus voltage plots, have long been used to extract information on the space charge region doping and barrier height in Schottky-barrier-type diodes. The meaning of the slope and voltage intercept of these $1/C^2$ versus voltage plots for reverse-biased diodes is reexamined in this analysis for the case when there is an inadvertent or purposeful interface layer present. The possibility of having interface states, one type of which communicates with the metal and another type of which communicates with the semiconductor, is considered, as is the fact that these two classes of states may, or may not, be able to follow an AC signal. The analysis first assumes that the densities of these states do not vary across the gap; this restriction is later relaxed and the possibility of variable densities of interface states is considered. The results of the analysis differ from those of previous studies. In general, it is found that most sets of interface state characteristics lead to nonlinear $1/C^2$ plots when an interfacial layer is present. Constant $1/C^2$ slopes (true straight line plots for all values of reverse bias) are found only if there are no interface states present or only if the states present have a constant density across the gap and follow the metal for all frequencies. (9 refs.)

67749 Formation of the Schottky barrier at the Pd/Si interface. R.J.Purtell, P.S.Ho, G.W.Rubloff, P.E.Schmid (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.834-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The formation of the Schottky barrier (SB) at the Pd-Si interface and its correlation to electronic and structural properties has been investigated. Experiments have been carried out using interfaces with thick and thin metal coverages. The thick contact experiment show that the SBH ϕ_b is independent of the bulk silicide structure and that it can be established upon Pd deposition at room temperature. In the thin contact experiment, the use of a synchrotron radiation source and high-resolution photoemission spectroscopy makes possible simultaneous observations of variations in SBH and valence band spectra from a clean Si surface up to several monolayers of metal coverage. The SBH values from thin and thick-contacts establish the true interface character of ϕ_b. Valence spectra show that SBH can be established without a full development of the metallic character of the reacted overlayer. Combining these results, the authors conclude that the SBH for the Pd-Si interface is determined by the basic interaction between Pd and Si atoms at the interface prior to the development of a metallic band structure and a well-defined silicide phase in the overlayer. (12 refs.)

67750 Stoichiometry effects on Schottky barrier and interface states in GaAs {001}/Al system. C.Barret, F.Chekir, T.Nefatti, A.Vapaille (Inst. d'Electronique Fondamentale, Univ. Paris-XI, Orsay, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.851-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Al growth by MBE has been achieved onto {001} GaAs surfaces with different reconstructions and stoichiometries. No correlation is observed between the initial surface characteristics and the barrier height of the obtained Schottky diodes. A study of interface states distribution by Schottky capacitance spectroscopy shows three kinds of states in the upper half of the gap. These states are not markedly affected by surface stoichiometry variations. (7 refs.)

67751 GaAs Schottky diode barrier heights related to surface and interface states. J.M.Palau, A.Ismail, E.Testemale, L.Lassabatere (Centre d'Etudes d'Electronique des Solides, Univ. Sci. Tech. du Languedoc, Montpellier, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.860-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
GaAs surface and diode results are reported. Surface Fermi level pinning is studied using the topographic Kelvin method. Pinning is caused by submonolayer metal deposition and by ion bombardment. Surface results are compared to diode barrier heights. (20 refs.)

67752 An iterated three-layer model of the double layer with permanent dipoles. J.R.MacDonald (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA), S.H.Liu.
Surf. Sci. (Netherlands), vol.125, no.3, p.653-78 (March 1983).
The problem is attached in a semi-discrete way by first partitioning the space charge region into layers parallel to the planar blocking electrode. Each layer is part of a cubic lattice with lattice-site spacing determined by the pure solvent concentration. Lattice sites may be occupied by ions of either sign or by solvent molecules, taken as spheres having a permanent dipole moment. The solvent molecule finite-length dipoles are then approximated by slabs of constant point-dipole polarization. Thus each of the planes parallel to the electrode is a locus of ion centers, and the polarization is accounted for by equal and opposite charge layers equidistant on either side of an ionic charge layer. The mean polarization and ionic concentration in each three-layer region are determined self-consistently by free energy minimization, and electrostatic equations are employed to couple the electrical conditions in one layer to those adjacent. This ion-dipole model (IDM) is solved self-consistently for arbitrary molarity in two regimes: the weak-field situation where the electrode charge approaches zero, and the arbitrary field-strength regime. (30 refs.)

67753 Surface properties of tin dioxide single crystals. E.de Fresart, J.Darville, J.M.Gilles (Dept. de Phys., Facultes Univ. Notre-Dame de la Paix, Namur, Belgium).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.518-22 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Measurements by low energy electron diffraction (LEED), by Auger electron spectroscopy (AES), of work function (CPD) and of surface conductance ($g_\square$) were performed at room temperature on faces (101) and (100) of SnO_2 submitted beforehand to ionic cleaning and annealing. The authors could identify four ranges of annealing temperatures similar to those observed for the (110) face. A reduced, amorphous and moderately conductive surface was produced below 130 ± 20°C. Then CPD decreased by 200 meV, $g_\square$ increased dramatically and below 310 ± 40°C recrystallization and reoxidation occurred giving, up to 400 ± 30°C, a diffuse p(1×1) structure. The latter became sharp at higher temperatures while CPD was steadily increasing. The evolution of surface stoichiometry is interpreted by a preferential sputtering of oxygen supplemented by tin segregation followed by oxygen diffusion from the bulk. Space charge theory indicates the existence of a degenerate accumulation layer at the surface. (14 refs.)

The adsorption study of tellurium on iron (001) surface by means of LEED, AES and $\Delta\phi$ ... See Entry 67361

Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). I. TPD, $\Delta\phi$, and UPS studies ... See Entry 67363

Investigation of the Cu/GaAs(110) interface formation ... See Entry 67377

Metal-induced crystallization of hydrogenated amorphous Si films ... See Entry 67404

Self-consistent nonlocal potentials near planar surfaces ... See Entry 67497

Electron states at abrupt metal-GaAs(110) interfaces ... See Entry 67727

Charge storage in a discontinuous Au film, deposited on Si ... See Entry 67777

Nickel and copper on cleaved indium phosphide: structure, metallurgy and electronic properties ... See Entry 67778

An XPS study of silicon/noble metal interfaces: bonding trends and correlations with the Schottky barrier heights ... See Entry 67779

Electronic states and Schottky barriers at Pd_2Si/Si(111) interfaces ... See Entry 67780

Measurements of depletion layers in hydrogenated amorphous silicon ... See Entry 67784

Determination of deep trap density in *n*-type epitaxial GaAs ... See Entry 67811

Non linear photoemission from silicon ... See Entry 68401

Photoemission studies of reactive diffusion and localized doping at II-VI compound semiconductor-metal interfaces ... See Entry 68404

Physisorption on a low work function metal: ARUPS from xenon on cesium ... See Entry 68408

73.40 INTERFACES

67754 Charge carrier escape rate from electrode-liquid interface. A.Prock, K.N.Das (Dept. of Chem., Boston Univ., Boston, MA, USA), P.Melman.
J. Chem. Phys. (USA), vol.78, no.7, p.4662-8 (1 April 1983).
Carrier photoinjection after excitation of low dielectric constant medium has been described in terms of forced diffusion of ions away from image forces at the electrode. The rate of this detachment process is expected to have a characteristic dependence on the strength of applied electric field at the electrode. The authors describe an extrinsic photoconductivity experiment using a thin layer cell where space charge modification by dark current of the local field due to injection or blocking effects can be made negligible. At high applied fields the authors find quantitative agreement of photocharge yield with the predicted characteristic behavior. This agreement strongly supports the correctness of the ion detachment model in such systems. (19 refs.)

Electronic excitations in K monolayer adsorbed on Si(100) 2×1 ... See Entry 67743

73.40G Tunnelling: general

(see also 74.50 in superconductors)

67755 Tunnelling through combined potential structures. II. Some examples. S.Takacs (CEFV SAV, Bratislava, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.2, p.73-92 (1983).
The general results for the tunnelling of particles through the system barrier-well-barrier (BWB), evaluated in a recent work of the author, are used for calculating some problems which can be important in the theory of electric and thermal conductivity of crystalline solids with impurities or in disordered structures. The temperature and electric-field dependence of the total transmission coefficient and the total amount of energy conducted by electrons with the Maxwell-Boltzmann distribution are calculated. They determine the electric conductivity and the electron component of the thermal conductivity of solids, respectively. The transmission time τ of electrons through the system BWB is shown to have analogous maxima as the transmission coefficient D. By comparing this time with the transmission time $\bar{\tau}$ between free states of the incoming electrons and the bound states of the well not occupied at this time (e.g. near ionized impurities)-which is also calculated in this paper the trapping probability of electrons by ionized impurities $\approx\tau/\bar{\tau}$ is given. It is shown further that the resonance tunnelling leads to negative-resistance regions in the current-voltage characteristics. The eigen-energies of the system BWB, which were needed for determining the time $\bar{\tau}$ are shown to be always larger than the eigen-energies of the corresponding single well. (13 refs.)

73.40J Metal-to-metal contacts

67756 Thermal- and mass transfer in liquid metal electrocontact bridges. S.N.Kharin.
Elektron. Obrab. Mater. (USSR), no.1, p.20-1 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
Within the framework of the thermal theory of bridge erosion of electrodes, a mathematical model is devised for representing bridge phenomena occurring when electrodes are disconnected. A description is given of the influence of a combination of various factors on processes in a bridge: the value of the current, surface tension, the 'pinch effect', the Joule-Lenz and Thomson effects, heat transfer between the bridge and a solid electrode, and the thermophysical and electrical characteristics. The result of a numerical solution of the dependency of growth of bridge diameter on the current is compared with experimental data. (3 refs.) *A.J.B.*

67757 Properties of Pd/Au thin film layered structures. P.F.Carcia, A.Suna (Central Res. & Dev. Dept., E.I. du Pont de Nemours & Co., Wilmington, DE, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2000-5 (April 1983).
The authors have synthesized, by RF sputtering, Pd/Au layered structures with periodicities (Pd+Au layers) that vary from 15-95 Å. The films have been characterized by X-ray diffraction. The individual metal layers have (111) orientation perpendicular to the plane of the film. They accurately model the positions and intensities of X-ray lines by a one-dimensional diffraction grating of Pd and Au layers and relate the observed X-ray line widths to loss of long-range layer coherence induced by dislocations at Pd-Au interfaces. They also find that the in-plane electrical resistivity of the films varies inversely, and the temperature coefficient of resistance directly with the layer period. They account for both of these trends by considering scattering of electrons from the metal interfaces, using a modified Fuchs theory. (25 refs.)

73.40L Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions

67758 Modulation doped GaAs-$Ga_{1-x}Al_xAs$ heterostructures grown by atmospheric pressure MOVPE. J.Maluenda, P.M.Frijlink (Labs. d'Electronique et de Phys. Appliquee, Limeil-Brevannes, France).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L127-9 (March 1983).
Single and multiple period modulation doped GaAs-$Ga_{1-x}Al_xAs$ heterostructures have been grown by atmospheric pressure metalorganic vapour phase epitaxy (AP-MOVPE). Single period structures exhibit electron mobilities of 6700, 80000 and 90000 $cm^2.V^{-1}.s^{-1}$ at 300K, 77K, and 4K for a sheet carrier concentration of 7.4×10^{11} cm^{-2}, 8.3×10^{11} cm^{-2} and 3.9×10^{11} cm^{-2} respectively. To the authors' knowledge, these values represent the best mobilities reported in this structure grown by AP-MOVPE. Preliminary results on field effect transistors show a three fold increase of transconductance as temperature decreases from ambient to 77K. Furthermore, the authors report mobility enhancement in 'inverted' structures in which the conducting accumulation layers are located at the interfaces formed by growth of GaAs on top of (Ga, Al)As. (10 refs.)

67759 Theory of silicon superlattices: Electronic structure and enhanced mobility. J.A.Moriarty (Dept. of Electrical & Computer Engng., Univ. of Cincinnati, Cincinnati, OH, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1892-902 (April 1983).
A realistic tight-binding band-structure model of silicon superlattices is formulated and used to study systems of potential applied interest, including periodic layered Si-$Si_{1-x}Ge_x$ heterostructures. The results suggest a possible new mechanism for achieving enhanced transverse carrier mobility in such structures: reduced transverse conductivity effective masses associated with the superlattice band structure. For electrons in [100]-oriented superlattices, a reduced conductivity mass arises intrinsically from the lower symmetry of the superlattice and its unique effect on the indirect bulk silicon band gap. An order of magnitude estimate of the range of mobility enhancement expected from this mechanism appears to be consistent with preliminary experimental results on Si-$Si_{1-x}Ge_x$ superlattices. (16 refs.)

67760 Electron density of the two-dimensional electron gas in modulation doped layers. K.Lee, M.Shur (Dept. of Electrical Engng., Univ. of Minnesota, Minneapolis, MN, USA), T.Drummond, H.Morkoc.
J. Appl. Phys. (USA), vol.54, no.4, p.2093-6 (April 1983).
The electron density of the two-dimensional electron gas in modulation doped structures is calculated as a function of the doping density in (Al,Ga)As, the thickeness of the undoped (Al,Ga)As layer, the lattice temperature, and other device parameters. The results of the calculation show that the depletion approximation is not accurate enough and that the Fermi-Dirac statistics (rather than the Boltzmann statistics) should be used in the calculation. A simple analytical model which takes these factors into account is shown to be in good agreement with the authors computer calculations and experimental data. The obtained results may be used to evaluate the maximum intrinsic transconductance and the maximum gate voltage swing for the modulation doped field effect transistors. (13 refs.)

67761 Spectral responses of the n-PbTe/p-$Pb_{1-x}Sn_xTe$ heterojunctions. W.Larkowski, A.Rogalski (Inst. of Tech. Phys., Military Acad. of Technol., Warsaw, Poland).
Opt. Appl. (Poland), vol.12, no.2, p.205-17 (1982).
The influence of the Burstein-Moss effect on the spectral dependence of the absorption coefficient for $Pb_{1-x}Sn_xTe$ and on the spectral characteristics of the n-PbTe/p-$Pb_{1-x}Sn_xTe$ heterojunctions have been analysed. It has been pointed out that for carrier concentration in $Pb_{1-x}Sn_xTe$ above 10^{25} m^{-3} the spectral cutoff of the heterojunction is determined by the PbTe material used. It has been also attempted to fit the characteristics calculated theoretically

for this kind of heterojunctions with those measured experimentally. (27 refs.)

67762 Effect of boundary conditions on hot electron transport in short semiconductors. C.Hamaguchi, K.Terashima, A.Shibatomi, O.Ryuzan (Dept. of Electronics, Osaka Univ., Osaka, Japan).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.238-40 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Importance of the boundary conditions in short semiconductors is demonstrated by solving current continuity and Poisson's equations iteratively. A new method to obtain drift velocity overshoot experimentally in short $n^+n\ n^+$ GaAs samples is described, which is based on the measurements and analysis of the current-voltage characteristics by taking into account of the boundary conditions. The observed overshoot velocity is about 7×10^7 cm/s at 3V application to GaAs sample with 1 μm channel length. The excess electrons near the n^+ contacts were found to result in $J\propto V^{3/2}$ relation in very short samples assuming drift motion for electrons. Therefore an observation of $J\propto V^{3/2}$ is not a good measure for the criterion of the ballistic transport. (10 refs.)

67763 Electron mobility and Landau level width modulation-doped GaAs-$Al_xGa_{1-x}As$ heterojunctions. P.Voisin, Y.Guldner, J.P.Vieren, M.Voos (Groupe de Phys. des Solides, Ecole Normale Superiere, Paris, France), J.C.Maan, P.Delescluse, N.T.Linh.

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.634-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Reports far infrared cyclotron resonance experiments in the high mobility two-dimensional electron gas occurring in modulation doped $Al_xGa_{1-x}As$-GaAs heterojunctions. The data extend over a wide range of temperatures and resonance magnetic fields. The width of the cyclotron resonance line depends strongly on the resonance magnetic field, and the data are interpreted in the framework of Ando and Uemura's (1974) theory. The authors have also investigated the temperature dependence of the linewidth, which is found to behave like the reciprocal Hall mobility. (15 refs.)

67764 $In_xGa_{1-x}As$-$In_yGa_{1-y}As$ strained-layer superlattices: A proposal for useful, new electronic materials. G.C.Osbourn (Sandia Nat. Labs., Albuquerque, NM, USA).

Phys. Rev. B (USA), vol.27, no.8, p.5126-8 (15 April 1983).

Strained-layer superlattices grown from lattice-mismatched layers of InGaAs are proposed as useful electronic materials with tailorable electronic properties. The first study of the electronic properties of these structures has been carried out. Band-gap energies are calculated as a function of layer thicknesses and compositions. The results demonstrate for the first time that the lattice constant, band gap, and transport properties of ternary strained-layer superlattices can be independently varied. This new capability could permit InGaAs strained-layer superlattices to significantly broaden the range of applications associated with the InGaAs ternary compound. (13 refs.)

67765 Intersubband plasmons of a semiconductor superlattice. W.L.Bloss (GTE Labs., Waltham, MA, USA).

Solid State Commun. (USA), vol.46, no.2, p.143-6 (April 1983).

Collective intersubband plasmon-like excitations are predicted to exist for a semiconductor superlattice. These modes arise because the single quantum well depolarization shifted intersubband excitation couples via the long-range Coulomb interaction with the corresponding excitations of the other quantum wells of the superlattice. The dispersion relation for these intersubband plasmons is obtained. (7 refs.)

67766 Differential negative resistance caused by inter-subband scattering in a 2-dimensional electron gas. K.Tsubaki, A.Livingstone, M.Kawashima, H.Okamoto, K.Kumabe (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).

Solid State Commun. (USA), vol.46, no.7, p.517-20 (May 1983).

Differential negative resistance has been observed in the range 0.5~1.2 kV/cm at 77K in a two-dimensional electron gas formed at a modulation-doped AlGaAs/GaAs heterojunction interface. This differential negative resistance is attributed to the sudden onset of inter-subband scattering when electrons achieve sufficient energy from the electric field. (19 refs.)

67767 Theory of double injection in structures with a variable-gap base. V.M.Arutyunyan, A.T.Darbasyan (State Univ., Erevan, USSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1251-3 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1938-41 (Nov. 1982). [received: April 1983]

An investigation is made of the current-voltage characteristics of a P^+-N-N^+ structure with a variable-gap base. Expressions are obtained for the electric field intensity in the base and the current-voltage characteristics are derived for a low injection efficiency. It is shown that a reduction in the band gap in the base toward an N^+-type emitter in the presence of sufficiently strong built-in fields may give rise to a negative resistance region in the current-voltage characteristics. (6 refs.)

67768 Investigation of the temperature and carrier-density dependences of the negative resistance of a silicon point-contact n^+-n junction. V.Blonskis, O.Vasilets, K.Repshas (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, Lithuanian SSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1257-9 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1947-50 (Nov. 1982). [received: April 1983]

An investigation was made of the dependence of a negative resistance region in the current-voltage characteristics of a silicon point-contact n^+-n junction on the resistivity of the n-type region (ρ=0.1-4 Ω.cm) at temperatures 78-290K. A reduction in the resistivity and cooling reduced the voltage at the beginning of the negative resistance region and the width of this region, which disappeared for $\rho\approx0.1$ Ω.cm. A numerical modeling experiment showed that the negative resistance decreased when the resistivity of the n-type region decreased because of a reduction in the influence of newly formed minority carriers on the electric field distribution. (10 refs.)

67769 Role of impact ionization in a quasineutral region of a reverse-biased p-n junction in the initiation of avalanche multiplication of carriers. I.V.Grekhov, A.F.Kardo-Sysoev, M.E.Levinshtein, S.V.Shenderei (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1276-9 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1977-82 (Nov. 1982). [received: April 1983]

An investigation is made of a new mechanism of initiation of an avalanche breakdown by impact ionization in a quasineutral region of a reverse-biased junction (diode). It is shown that this mechanism may play an important role in the operation of high-power voltage-peaking circuits utilizing semiconductor devices and can contribute significantly to the initiation of an avalanche in the case of some operating modes of avalanche-transit diodes that are of practical importance. Simple analytic expressions are obtained for estimating the effectiveness of the proposed mechanism. (18 refs.)

67770 Electrical properties of 6H-SiC p-n junctions with an epitaxial p^+-type Al-doped layer. R.G.Verenchikova, Yu.A.Vodakov, D.P.Litvin, E.N.Mokhov, M.G.Ramm, V.I.Sankin, A.G.Ostroumov, V.I.Sokolov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1309-11 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2029-32 (Nov. 1982). [received: April 1983]

Epitaxial growth of a p^+-type Al-doped layer on an n-type base made of 6H-SiC at temperatures 2000-2200°C resulted in the formation in the boundary layer of a region with a high concentration of intrinsic donor-type defects; the thickness of this region was less than 0.1 μ. This was deduced from the capacitance-voltage (C-U) characteristics and also from electroluminescence with features characteristic of defects. This boundary region resulted in a considerable deterioration of the parameters of p-n junctions, particularly of the reverse breakdown voltage U_{br}. The appearance of low-voltage microplasmas was attributed to clusters of intrinsic defects. This was confirmed by the effects of high-temperature annealing, which destroyed such clusters and, consequently, increased the value of U_{br} to the avalanche breakdown voltage of an asymmetric p-n junction with a corresponding net impurity concentration N_d-N_a. (14 refs.)

67771 Formation of p-n junctions in n-type InSb by pulsed laser radiation. S.G.Kiyak, G.V.Savitskii, V.V.Vasil'kova, A.N.Popkov, M.N.Kevorkov (Inst. of Appl. Problems of Mech. & Math., Acad. of Sci., Lvov, Ukrainian SSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1321-2 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2046-8 (Nov. 1982). [received: April 1983]

The authors report a study of the characteristics of the interaction of pulsed laser radiation with InSb single crystals and estimate the effectiveness of laser radiation in the process of inversion of conduction of a surface layer of n-type InSb and consequent fabrication of photosensitive p-n junctions. Laser irradiation was applied to undoped n-type InSb single crystals with a carrier density $\sim10^{14}$ cm^{-3} and a mobility $6.5.10^5$ $cm^2.V^{-1}.sec^{-1}$ at 77K. (7 refs.)

67772 Influence of free carriers on the potential of periodic impurity structures in semiconductors. V.A.Ivanchenko, V.S.Karakhtanov, B.N.Klimov (Sci.-Res. Inst. of Mech. & Phys., N.G. Chernyshevski State Univ., Saratov, USSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1323-4 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2048-50 (Nov. 1982). [received: April 1983]

In the discussion of periodic structures in semiconductors, the contribution of free carriers to the form of the potential has usually been neglected. There are, however, structures in which this contribution is comparable with the potential which determines the structure. The study of such periodic structures is important because of their possible applications in semiconductor technology. The authors consider a periodic structure of p-n junctions in which the p-type and n-type layers have equal thicknesses d/2. (3 refs.)

67773 Preparation and properties of n-Si-n-ZnO heterostructures. R.A.Rabadanov, I.Sh.Aliev, M.K.Guseikhanov (V.I. Lenin Dagestan State Univ., Makhachkala, USSR).

Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1334-5 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2065-8 (Nov. 1982). [received: April 1983]

Describes the preparation and the reports the results of an investigation of the electrical and photoelectric properties of n-Si-n-ZnO structures. Polycrystalline zinc oxide films were deposited by the method of chemical transport in a hydrogen atmosphere on single-crystal silicon plates 3×10^{-2} cm thick. In contrast to homojunctions in Si, the investigated heterojunctions are characterized by a wider photosensitivity spectrum and a selection of the optimal carrier density in silicon as well as of the conditions during the deposition of ZnO films can ensure fairly high conversion efficiency. The energy band diagram of n-Si-n-ZnO heterojunctions agrees with the Anderson model. (6 refs.)

67774 Pulsed electron beam annealing of ion implanted germanium for photovoltaic devices. B.Sautreuil, A.Laugier, D.Barbier (Inst. Nat. des Sci. Appliquees de Lyon, Villeurbanne, France), A.Cachard.

Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.453-8

The paper deals with the application of short (50 ns) high energy, pulsed electron beam for shallow p-n junction formation in implanted germanium. From time-resolved spectroscopy achieved by means of analysis of diode current and voltage, energy deposition profiles are obtained on the basis of a Monte-Carlo simulation. Temperature-depth profiles are computed. Structures of the annealed samples are studied by RBS plus channeling and SEM. A good annealing is obtained for energy densities above 0.45 J/cm^2 for 12-15 keV mean electron energy. The use of the Ge photovoltaic devices achieved by pulsed electron beam annealing is discussed in the case of Ge-GaAs bicolar systems. (8 refs.)

67775 Potential applications of poly-silicon as an electronic-device material. D.J.Bartelink (Stanford Univ., Stanford, CA, USA).

Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.249-60

Poly-crystalline silicon can be regarded as a true electronic material if good p-n junctions can be made in it or if its state of depletion can be altered by reasonable gate voltages. The three main detrimental effects of grain boundaries on electronic-device function are the action of grain boundary traps as extra charge centers, lifetime killers, and mobility-reducing scattering centers. The current trend in reducing or almost eliminating grain boundaries by laser recrystallization or lateral epitaxy has the effect of reducing the average number of traps. In terms of potential applications of the material, the improvement derived from these procedures must be balanced against other constraints placed on the overall structure. For example, the thickness and quality of the lower oxide (and interface) in these processes will determine whether an electronically active lower gate function is practical. Some currently envisioned applications are discussed. (22 refs.)

Carrier transport in stripe-geometry $Ga_{1-x}Al_xAs$ double heterostructure diode lasers and broad area heterojunctions ....See Entry 66276

Cyclotron resonance studies of polarons and screening effects in GaAs ....See Entry 67486

Study of impurity states in a n-n GaAs-AlGaAs heterojunction using cyclotron resonance and Shubnikov-de Haas experiments ....See Entry 67511

Electron structure and electrical conductivity of the interface in a semiconductor bicrystal ....See Entry 67582

Grain boundaries in crystallized silicon thin films See Entry 67619

Observation of quantized Hall effect and vanishing resistance at fractional Landau level occupation See Entry 67657

Magnetophonon oscillation of thermoelectric power—anomalous behaviour in p-type-to-intrinsic transition region of InSb See Entry 67666

Energy band-gap shift with elastic strain in $Ga_xIn_{1-x}P$ epitaxial layers on (001) GaAs substrates See Entry 67812

Oscillations of the cyclotron resonance linewidth with Landau level filling factor in GaAs/AlGaAs heterostructures See Entry 68026

Observation of oscillatory linewidth in the cyclotron resonance of GaAs-$Al_xGa_{1-x}As$ heterostructures See Entry 68028

Light scattering by two dimensional electron systems See Entry 68247

Fabrication on large area Cu_2S/CdS thin film solar modules See Entry 68885

Gas immersion laser diffusion: a new method for making efficient Si solar cells See Entry 68887

Study of the grain boundary effects in N-P junction polycrystalline Si solar cells See Entry 68888

Recent advances in ITO/InP and Cds/InP solar cells See Entry 68889

Non-linear increase and decrease of open circuit voltage of n^+-p-p^+ silicon solar cells at high illumination level See Entry 68891

73.40M Semiconductor-electrolyte contacts

67776 Photoelectrochemical study of TiNi alloy oxide layer. V.B.Chougule, S.H.Pawar (Phys. Dept., Shivaji Univ., Kolhapur, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.942-4 (Dec. 1982). [received: April 1983]
The photoelectrochemical (PEC) behaviour of alloy oxide semiconductor electrodes prepared by direct oxidation of TiNi alloy has been investigated. The *I-V* characteristics, power and speed of response characteristics of the PEC cell have been studied. An attempt has been made to explain the speed of response characteristics on the basis of a four-electron reaction occurring in the presence of oxygen molecules adsorbed in the electrolyte. (10 refs.)

A flux analysis of the current-voltage characteristics of thin film frontwall illuminated and backwall illuminated liquid junction and metal junction solar cells See Entry 68868

73.40N Metal-nonmetal contacts

67777 Charge storage in a discontinuous Au film, deposited on Si. E.Alkabetz, G.Gorodetsky, V.Volterra (Dept. of Phys., Ben Gurion Univ., Beer Sheva, Israel).
J. Appl. Phys. (USA), vol.54, no.4, p.2128-9 (April 1983).
Relatively large Au islands of the order of 1 μm and a density of $\sim 10^7/cm^2$, in coexistence with much smaller Au islands, were deposited on an *n*-type Si. The observed, randomly distributed Au/Si Schottky junctions, exhibited a diode charge storage with a time constant, $RC \approx 1$ ms. (6 refs.)

67778 Nickel and copper on cleaved indium phosphide: structure, metallurgy and electronic properties. G.J.Hughes, A.McKinley, R.H.Williams (School of Phys. Sci., New Univ. of Ulster, Coleraine, Ireland).
J. Phys. C (GB), vol.16, no.12, p.2391-405 (30 April 1983).
Previous studies of Schottky barrier formation between metals and clean cleaved (110) surfaces of n-type InP have shown that chemically reactive metals (Ni, Fe, Al) pin the Fermi level relatively close to the conduction band whereas unreactive metals (Cu, Ag, Au) lead to pinning closer to mid-gap. The authors have selected Ni and Cu, as representative of each group, and studied the detailed interactions between these and the InP surface using a range of experimental techniques. These include LEED, Auger and photoemission using a laboratory source (He I radiation) as well as a synchrotron source. Nickel was found to interact very strongly with the surface resulting in the formation of nickel phosphides at the interface and the metallic indium diffusing out into the Ni contact. Copper interacts much more weakly with the surface, the core level and valence band photoemission spectra contrast markedly to the behaviour observed for Ni. The formation of Schottky barriers has also been probed by monitoring appropriate shifts in the photoemission spectra. The importance of the interactions at the interface on Schottky barrier formation is considered. Interface widths are also discussed. (29 refs.)

67779 An XPS study of silicon/noble metal interfaces: bonding trends and correlations with the Schottky barrier heights. P.J.Grunthaner, F.J.Grunthaner (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.831-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
This X-ray photoemission (XPS) study demonstrates a correlation of intrinsic TM-Si chemical bond formation with Schottky barrier heights for the near-noble transition metals (TM=Ni, Pd, Pt) and their corresponding silicides (TM_2Si and TMSi) on Si(100). The barrier height correlates with the strength of the TM-Si orbital interaction as well as with the charge density around the Si atom. These observations suggest a dominant role for intrinsic chemical interactions in establishing the Schottky barrier heights in these TM-Si systems. (16 refs.)

67780 Electronic states and Schottky barriers at Pd_2Si/Si(111) interfaces. F.Herman (IBM Res. Lab., San Jose, CA, USA), F.Casula, R.V.Kasowski.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.837-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
It is possible to account for measured Pd/Si Schottky barrier heights (0.71-0.73 eV) by assuming that the interface between Si and Pd_2Si includes a hexagonal Si transition region induced by the presence of Pd impurities. With the Fermi level pinned slightly above the Si valence band edge by hydridized Pd-Si states at the interface, as calculations indicate, the Schottky barrier height is determined primarily by the band gap of hexagonal Si, which is about 0.85 eV. Since Pd atoms are larger than Si atoms, isolated substitutional and interstitial Pd atoms are not readily incorporated into the Si lattice. The authors believe that the Pd impurities form triangular clusters at Si vacancies. Since these clusters are more easily accommodated in hexagonal than in cubic Si, the Si stacking sequence changes from cubic to hexagonal, giving rise to the transition region. (15 refs.)

67781 Electronic properties of gold-silicon (111) 7×7 interfaces. F.Houzay, G.M.Guichar, A.Cros, F.Salvan, R.Pinchaux, J.Derrien (LURE, Univ. Paris Sud, Orsay, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.840-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Au films on 7×7 starting Si surfaces have been investigated by ARUPS using synchrotron radiation and related surface techniques (LEED, AES). At room temperature (RT), the authors observe the early stages of the formation of an alloyed zone $Au_{1-x}Si_x$. After annealing of one gold monolayer (mL) an ordered surface structure is obtained ($\sqrt{3}.\sqrt{3}$ R(30°) LEED pattern). It gives rise to new interface states and appears to be insensitive to oxygen, in contrast to the one mL RT gold deposit. (12 refs.)

67782 Systematic study of 3d transition metal-silicon interfaces by photoemission. Y.Shiraki, K.L.I.Kobayashi (Central Res. Lab., Hitachi Ltd., Tokyo, Japan), H.Daimon, A.Ishizuka, S.Sugaki, Y.Murata.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.843-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Photoemission measurements are done on nickel silicide crystals (Ni_xSi; x=3, 2.5, 2, 1.5, 1, and 0.5) and interfacial compounds formed by Cr, Mn, Co, Ni, and Cu deposition onto cleaved Si surfaces with the use of synchrotron radiation as a light source. The electronic structures in the valence-band region near the Fermi level of these compounds are explained by a simple rigid-band model. (5 refs.)

67783 Si-metal interface reaction and bulk electronic structure of silicides. A.Franciosi, J.H.Weaver (Univ. of Wisconsin, Madison, WI, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.846-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Summarizes synchrotron radiation photoemission results for cleaved, bulk 3d transition metal disilicides and for the interfaces of Si(111)-Cr, Si(111)-Ti, Si(111)-Ca, and Si(111)-Sm. (11 refs.)

67784 Measurements of depletion layers in hydrogenated amorphous silicon. R.A.Street (Xerox Palo Alto Res. Center, Palo Alto, CA, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4924-32 (15 April 1983).
The use of transient photoconductivity for measuring and profiling the depletion-layer electric field in amorphous silicon is described. Charge-collection measurements yield the depletion-layer width, and this technique is used to study various sample structures. The internal-field profile is obtained from the transient photocurrent response. The author reports measurements on Cr, Pd, and Pt contacts and obtain the built-in potentials and density-of-states data. (15 refs.)

Investigation of the Cu/GaAs(110) interface formation See Entry 67377

Mott transition in layer semiconductors See Entry 67458

Anomalous increase in the dielectric function of thin semiconducting films in contact with metals See Entry 67499

Study of metal-semiconductor interface states using Schottky capacitance spectroscopy See Entry 67715

Electron states at abrupt metal-GaAs(110) interfaces See Entry 67727

A reevaluation of the meaning of capacitance plots for Schottky-barrier-type diodes See Entry 67748

Formation of the Schottky barrier at the Pd/Si interface See Entry 67749

Stoichiometry effects on Schottky barrier and interface states in GaAs {001}/Al system See Entry 67750

Photoemission studies of reactive diffusion and localized doping at II-VI compound semiconductor-metal interfaces See Entry 68404

A flux analysis of the current-voltage characteristics of thin film frontwall illuminated and backwall illuminated liquid junction and metal junction solar cells See Entry 68868

73.40Q Metal-insulator-semiconductor structures

(inc. semiconductor-to-insulator)

67785 Measurement of cube-root broadening of charge packets in metal-oxide-semiconductor structures. D.F.Nelson, D.L.Abraham, J.A.Cooper,Jr. (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.815-17 (1 May 1983).
The spatial width of electron packets drifting in a nearly uniform electric field in a metal-oxide-semiconductor structure is determined from flux pulse measurements. The width is found to broaden as the cube root of time, thus verifying an earlier prediction. Furthermore, the broadening rate constant is found to agree with that predicted to within 7%. (7 refs.)

67786 Determination of the generation lifetime and surface generation velocity by voltage step method. Zhang Xiu-Miao (Dept. of Phys., Hangzhou Univ., China), Bao Zong-Ming, Su Jiu-Ling.
Acta Phys. Sin. (China), vol.32, no.2, p.239-46 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Simple method for determining both the generation lifetime and surface generation velocity is suggested. By this method, using the data of three points from the MOS capacitance transient response to a step voltage, both the generation lifetime and surface generation velocity can be calculated readily. The experimental results show that this method is reasonable, and indicate that neglecting surface generation velocity would result in reducing of apparent generation lifetime. (9 refs.)

67787 Determination of semiconductor quasi-Fermi level separation under illumination. S.Kar, S.Varma (Dept. of Electrical Engng., Indian Inst. of Technol., Kanpur, India).
J. Appl. Phys. (USA), vol.54, no.4, p.1988-90 (April 1983).
Two new experimental techniques are described for the determination of the quasi-Fermi level separation in a semiconductor material, exposed to illumination. In one method, this separation is obtained from the change in the value of the measured high frequency capacitance of a transparent conductor-oxide-silicon structure in strong inversion, with the intensity of optical illumination. In the other method, the quasi-Fermi level separation is obtained from the shift of the experimentally obtained low frequency space-charge capacitance versus the surface potential curve in strong inversion. Results obtained from the two techniques agreed well. (9 refs.)

67788 Modification of the transient capacitance analysis of GaAs MIS structures for minority carrier lifetime determination. A.B.Bhattacharyya (Centre for Appl. Res. in Electronics, Indian Inst. of Technol., New Delhi, India), E.Lakshmi.
J. Appl. Phys. (USA), vol.54, no.4, p.2116-18 (April 1983).
The insulators of GaAs MIS structures, because of their low temperature deposition, have relatively low resistivities compared to SiO_2. This is respons-

ible for finite leakage through the insulator when a voltage is applied across the MIS structure. The present work reports on the implications of leakage on the transient capacitance plot which is widely used for the determination of minority carrier lifetime in semiconductors. (13 refs.)

67789 Electron-electron scattering in silicon inversion layers. R.A.Davies, M.Pepper (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
J. Phys. C (GB), vol.16, no.12, p.L353-60 (30 April 1983).
The authors present the results of an investigation of the rate of electron-electron scattering in the two-dimensional electron gas of the Si inversion layer. The electron-electron scattering rate was extracted by analysis of the negative magnetoresistance in the regime of weak localisation when $k_F l > 1$, where k_F is the Fermi wavevector and l is the mean free path for elastic scattering. The results showed that over a wide range of $k_F l$, carrier concentration and electron mobility the scattering rate was given by two processes which were additive. The first was the normal T^2 (Landau-Baber) law and the second was the T law expected when the effects of disorder are considered. There was no evidence for the recently proposed $T \ln T$ law. (25 refs.)

67790 Non-metallic transport in silicon inversion layers and the Hall effect. R.A.Davies, M.Pepper (Cavendish Lab., Univ. of Cambridge, Cambridge, England).
J. Phys. C (GB), vol.16, no.12, p.L361-7 (30 April 1983).
The authors present results on the Hall effect in the Si inversion layer in the regime where the temperature dependence of the conductivity is due to corrections arising from the electron-electron interaction. They find that the temperature dependence of the Hall coefficient is independent of the magnitude of the magnetic field which does, however, have a pronounced effect on the temperature dependence of the conductivity. This is not explained by present theories, and suggests that whereas the effects of screening on the conductivity are well understood this is not the case with the Hall effect. (23 refs.)

67791 Thermomagnetic coefficients of inversion layer in high magnetic field. P.Streda (Inst. of Phys., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
J. Phys. C (GB), vol.16, no.12, p.L369-74 (30 April 1983).
The resistivity, thermopower and thermal conductivity of a two-dimensional electron gas (inversion layer) in high magnetic field has been calculated using the Kubo formula. It has been found that all transport coefficients are universal functions of the reduced temperature $k_B T/\hbar\omega_c$ and the reduced chemical potential $\mu/\hbar\omega_c$, provided that the thermal broadening $k_B T$ is substantially greater than the width of the Landau levels. (6 refs.)

67792 Valley splitting and valley degeneracy in n-type silicon (110) inversion layers. H.Kohler, M.Roos (Phys. Inst., Univ. Wurzburg, Wurzburg, Germany).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.579-87 (1983).
The magneto-quantum transport phenomena of silicon (110) *n*-type inversion layers directly reveal the presence of two types of electrons in i=O and O′ electric subband states from their respective quantum oscillations. While the higher i=O′ states are occupied by only about 6% of the total electron concentration in the authors' samples, the i=O electrons populate two valley pairs each, the level ladders of which are shifted in energy by less than the Landau splitting in the range where quantum oscillations are observed. They propose this effect to originate from a slight misorientation ($\Delta\theta < 0.5°$) of the surfaces investigated with respect to the (110) axis. Hence, increasing the gate voltage in a quantizing magnetic field all four i=O valleys are alternatingly occupied in pairs with increasing Landau quantum number in the (110) surfaces contrary to former conclusions on samples with comparable properties. The effect of the magnitude of $\Delta\theta$ on the resulting magneto-quantum oscillations is unimportant for $0 < \Delta\theta \lesssim 0.5°$ as a result of energy minimization for the total electron system. (30 refs.)

67793 Transition from 1-dimensional to 2-dimensional hopping conductivity in silicon accumulation layers. A.B.Fowler, A.Hartstein, R.A.Webb (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.661-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Uses p^+ diffusions to confine electrons in an accumulation layer of n−silicon. This allowed for electrical control of the channel width. When the channel was narrowest the conductance followed $\ln\sigma = -(T_o/T)^{1/2}$; when it was wider it followed $\ln\sigma = -(T_o'/T)^{1/3}$. These results are consistent with a transition from 1 D to 2 D variable range hopping. Strong structure in the conductance as a function of carrier concentration occurred which may be the result of fluctuations in the density of states in the band tail. In the 1 D range, the effect of high magnetic field is to increase the power law; in the 2 D range, magneto-oscilations were observed above 7 T. (14 refs.)

67794 Nonmetallic localization and interaction in one-dimensional (0.1 μm) Si MOSFETs. W.J.Skocpol, L.D.Jackel, R.E.Howard, E.L.Hu, L.A.Fetter (Bell Labs., Holmdel, NJ, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.667-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have fabricated Si MOSFETs having parallel arrays of narrow (0.1 μm) conducting channels. They observe a divergent, nonmetallic decrease of conductance below 30K that is in excellent quantitative agreement with the one-dimensional version of the combined theories for weak localization and interaction effects. They also observe structure in the conductance as a function of gate voltage that they attribute to random variations of the density of states, rather than the regular variations expected for simple one-dimensional quantization. (9 refs.)

67795 1-D minigaps in the subband structure of inversion layers on p-InSb. T.Evelbauer, U.Merkt, J.P.Kotthaus (Inst. fur Angewandte Phys., Univ. Hamburg, Hamburg, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.670-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Polarization dependent microwave transmission measurements have been performed on electron inversion layers on high-index surfaces of the single-valley semiconductor InSb. Minigaps are detected in the quasistatic field-effect mobility vs. gate voltage curves as structures, that appear in addition to the mobility peak and the onset of the occupation of higher subbands. The interpretation of these structures as caused by 1-D minigaps in the 2-D subband structure is supported by their energetical position which coincides with theoretical predictions as well as by their polarization dependent influence on the microwave absorption. (7 refs.)

67796 SiH and SiOH electromodulation at Si-SiO$_2$ interfaces in a multiple internal reflectance configuration. A.Stella (Istituto di Fisica Generale, Pavia, Italy), L.Miglio, E.D.Palik, R.T.Holm, H.L.Hughes.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.777-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Electromodulation of SiH and SiOH vibrational bands at a hydrogen-implanted Si-SiO$_2$ interface in a multiple-internal-reflectance configuration is reported. Dipole strengthening and Stark shifts are calculated and theoretical lineshapes derived from their combinations are compared with the experimental electromodulation curves. (7 refs.)

67797 Time-of-flight measurements in a-Si alloy films predominance of displacement current effects. M.Silver, E.Snow, B.Wright, M.Aiga, L.Moore (Dept. of Phys. & Astron., Univ. of North Carolina, Chapel Hill, NC, USA), V.Cannella, R.Ross, S.Payson, M.P.Shaw, D.Adler.
Philos. Mag. B (GB), vol.47, no.4, p.L39-44 (April 1983).
The photoresponse through a p-i-n a-Si:F:H structure from 200 ps laser excitation has been studied by reversing the internal electric field during the current pulse. The initial photocurrent does not change sign. This proves that the photoresponse resulting from the laser excitation is due to displacement currents originating in the junction space-charge region rather than the drifting carriers. Pulsed high-level injection results for the same samples yield a value of approximately 800 cm^{2}V^{-1} s^{-1} for the majority-carrier band mobility. (6 refs.)

67798 Observation of the second subband occupation in the *p*-type (111) Si inversion layer. G.M.Gusev, Z.D.Kvon, I.G.Neizvestnyi, V.N.Ovsyuk (Inst. of Semiconductor Phys., Acad. of Sci., Novosibirsk, USSR).
Solid State Commun. (USA), vol.46, no.2, p.169-70 (April 1983).
Reports observations of the features in the conductivity and the anomalous magnetoresistance of a two-dimensional hole gas near (111) silicon surface, which gives evidence for the onset of second subband occupation at a hole density $p_s \approx 5.3 \times 10^{12}$ cm^{-2}. (7 refs.)

67799 Frequency dependent Shubnikov-de Haas oscillations in Si-MOS-FET under high magnetic fields. Y.Iwasa, G.Kido, N.Miura (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Solid State Commun. (USA), vol.46, no.3, p.239-42 (April 1983).
The quantum oscillations in the AC magnetoconductance was studied for inversion layers in Si-MOS-FETs under high magnetic fields at 1.5K. Each peak in the Shubnikov-de Haas oscillation was found to be remarkably sharpened with increasing frequency up to 50 MHz. It was also found that the width of the gate voltage for non-conductive region (σ_{xx}=0) increases with increasing frequency. (24 refs.)

67800 Quantum Hall studies in Si MOSFETs for $\nu \leq 1$. D.A.Syphers (Dept. of Phys., Brown Univ., Providence, RI, USA), J.S.Brooks, P.J.Stiles.
Solid State Commun. (USA), vol.46, no.3, p.243-5 (April 1983).
The authors have observed inhibition of the Hall effect for densities within the lowest Landau level and demonstrate that a system of non-interacting electrons cannot account for this behavior. They also show that the usual method for determining conductivity parameters could cause errors at low densities and suggest a new method for determining these parameters. (12 refs.)

67801 Theory of the quantized Hall conductivity plateaus of two-dimensional electron systems. A.Isihara (Dept. of Phys., State Univ. of New York, Buffalo, NY, USA).
Solid State Commun. (USA), vol.46, no.3, p.265-7 (April 1983).
The width of the plateaus of the quantized Hall conductivity of two-dimensional electron systems is expected to drop sharply as a function of $\mu_B H/kT$ from the zero point value of $2m\mu_B H/\pi\hbar^2$, when it is expressed in terms of electron density. (4 refs.)

67802 Generating properties of Al-Tb$_2$GeS$_5$-Ge MIS structures. V.F.Agafonnikov, V.I.Gaman, S.F.Glushchuk, L.I.Terekhina.
Sov. Phys. J. (USA), vol.25, no.7, p.603-6 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.28-31 (July 1982). [received: May 1983]
The nature of AC generation in an aluminum-amorphous terbium thiogermanate-monocrystalline germanium structure is discussed. An expression obtained for the frequency (f) of the generated current satisfactorily describes the experimentally observed dependences of f on the load resistance R_L, temperature, thickness of the Tb$_2$GeS$_5$ film, and the area of contact with it (S). The specific rate of carrier generation in the germanium space-charge region is calculated from plots of f^{-1} against R_L and S. (5 refs.)

67803 Theory of MOSFET operation in small-grain polysilicon. S.W.Depp, B.G.Huth, A.Juliana, R.W.Koepcke (IBM Res. Lab., San Jose, CA, USA).
Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.297-309
The operation of a MOSFET transistor fabricated in undoped, small-grain polysilicon is considered, and a model is developed which can predict threshold and drain current as a function of gate voltage. A two-dimensional calculation is described for the band-bending under the influence of a gate potential with the assumption that the grain boundaries are repetitive and oriented at right angles to the gate-oxide/polysilicon interface. Both hole and electron traps are assumed present at the grain boundaries and are coincident in energy with the intrinsic Fermi level at room temperature. An energy barrier to the flow of carriers is present in the undoped polysilicon, and the magnitude of this energy barrier is dependent on the gate voltage. The band-bending occurs over much shorter distances than the intrinsic Debye length, and the trapped charge at the grain boundaries behaves very similarly to the charged impurities in a depletion model. The two-dimensional model can be approximated by a one-dimensional calculation for the band-bending by making the assumption that the trapped charge is uniformly distributed throughout the grain. The results of this calculation can be used to calculate the magnitude of the free carriers in the channel region. Using this information, the dependence of the potential barrier on gate voltage, and the gradual channel approximation for an FET, one can compute the drain current vs. gate voltage, and the results of these calculations are given for parameters used in fabricating actual devices. Finally, experimental results are compared with the model for typical transistors fabricated in undoped, small-grain polysilicon. (7 refs.)

Conduction in two-dimensional electron systems having a one-dimensional superlattice .... See Entry 67584

High electric field effect on negative magnetoresistance in Si (001) n-inversion layers .... See Entry 67654

73.40R Metal-insulator-metal structures

67804 Annealing behavior of the Kondo-type zero-bias conductance peak in Ta-Ta$_2$O$_5$-Ag tunneling junctions. M.Brunner, H.Ekrut, A.Hahn (Inst. fur Werkstoffe der Elektrotech., Ruhr-Univ. Bochum, Bochum, Germany).
Solid State Commun. (USA), vol.46, no.3, p.259-61 (April 1983).
In annealing Ta-Ta$_2$O$_5$-Ag tunneling junctions the oxide barrier of which has been prepared by short-time room temperature oxidation, the authors observe a systematic decrease of the well-known Kondo-Appelbaum zero-bias anomaly. This decrease is due to electron transfer from low oxidation state magnetic Ta ions in the barrier near the Ta electrode to oxygen near the Ag electrode. (11 refs.)

67805 Formation of high asymmetric oxide tunnelling barriers on niobium and tantalum. A.Hahn, M.Brunner, H.Ekrut (Inst. fur Werkstoffe der Elektrotech., Ruhr-Univ., Bochum, Germany).
Thin Solid Films (Switzerland), vol.102, no.3, p.221-30 (22 April 1983).
A background tunnelling conductance that is only slightly voltage dependent and is asymmetric with respect to bias polarity has been observed for Nb/(niobium oxide)/Ag and Ta/(tantalum oxide)/Ag tunnelling junctions, indicating unusually high asymmetric barriers. These barriers result from chemisorption of anions on the oxide surface after countercontacting. The anions (representing less than one-tenth of a monolayer) must be supplied by grain boundary or bulk diffusion from the dirty silver surface. For tantalum, all stages of barrier formation are observable during thermal annealing or voltage annealing. For niobium, formation proceeds in the unmeasurably small resistance regime and only the final state is observable. The process is restricted to an oxide thickness below 20 Å corresponding to room temperature oxidation times shorter than 1 hour. (16 refs.)

Preferential orientation of formic acid adsorbed on Al oxides ....See Entry 67369

73.40S Metal-semiconductor-metal structures

67806 Thermionic emission current in the MSM system. J.Stepniewski, M.J.Malachowski (Inst. of Tech. Phys., Military Acad. of Technol., Warszawa, Poland).
Electron Technol. (Poland), vol.13, no.1-2, p.67-77 (1980).
The authors are concerned with the numerical analysis of carrier transport through a system of metal-semiconductor-metal (MSM). It has been assumed that over-barrier thermionic emission is the main mechanism of carrier transport. Both two barrier system (where the semiconductor is not completely depleted) and single barrier system (the semiconductor is completely depleted) are considered. Distributed of an external voltage applied to the system on two barriers has been found. Numerical analysis of the influence of semiconductor parameters (doping concentration, thickness, temperature, barrier height) on current density, as a function of voltage, clearly shows that minority current predominates over majority current in the single-barrier system, as opposed to MS contact or two-barrier MSM contact. (10 refs.)

Injection-stimulated blackening of As$_2$Se$_3$ films ....See Entry 67823

73.60 ELECTRONIC PROPERTIES OF THIN FILMS

67807 2D to 3D percolation crossover in the resistivity of co-evaporated Al-Ge mixture films. A.Kapitulnik, G.Deutscher (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).
J. Phys. A (GB), vol.16, no.7, p.L255-7 (11 May 1983).
The authors demonstrate, experimentally, the percolation dimensionality crossover as it is reflected in the resistivity measurements of co-evaporated Al-Ge random mixture films. The resistivity exponents as well as the correlation length exponent and its amplitude are found to be in good agreement with the theory. (11 refs.)

73.60D Metallic thin films

67808 Electron localization and interaction in two-dimensional magnetic films. F.Komori, S.Kobayashi, W.Sasaki (Dept. of Phys., Univ. of Tokyo, Tokyo, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.74-6 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
Temperature and magnetic field dependence of conductivity was studied in Ni, Mn and Cu-Mn films. The results are consistent with the recent theories of the Anderson localization and the Coulomb interaction between electrons in two dimensional disordered metals when the spin scattering time is taken into account. (13 refs.)

Properties of Pd/Au thin film layered structures .... See Entry 67757

73.60F Semiconductor films

67809 Electrical properties of AgGaSe$_2$ epitaxial layers. H.Neumann, E.Nowak, B.Schumann, G.Kuhn (Sektion Phys. und Sektion Chem., Karl-Marx-Univ. Leipzig, Leipzig, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.477-81 (1983).
Epitaxial layers of AgGaSe$_2$ with thicknesses in the range from 50 to 70 nm were deposited onto (111)A-oriented semi-insulating GaAs substrates by flash-evaporation in the substrate temperature range T_s=825...900K. Films grown at $T_s \leq 850$K are n-type conducting whereas p-type conductivity was observed at $T_s \geq 875$K. In the p-type samples two acceptor states with ionization energies of 60 and 410 meV were found from an analysis of the electrical measurements. (27 refs.)

67810 The effect of the structure of polycrystalline Cd$_x$Hg$_{1-x}$Te (x=0.1) thin films on their admittance. E.Z.Pawlak (Inst. of Electron Technol., Warsaw Tech. Univ., Warszawa, Poland).
Electron Technol. (Poland), vol.13, no.1-2, p.43-53 (1980).
The author presents the results of the investigation of the admittance of Cd$_x$Hg$_{1-x}$Te (x=0.1) thin films of various grain size and number of boundary regions. The obtained results reveal a relation between the crystalline structure of the films and the admittance measured by a contactless HF method in the range 1 to 250 MHz. (9 refs.)

67811 Determination of deep trap density in *n*-type epitaxial GaAs. A.K.Saxena (Dept. of Electronics & Communication Engng., Univ. of Roorkee, Roorkee, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.923-5 (Dec. 1982). [received: April 1983]
A new analysis of the capacitance-voltage relationships for a Schottky barrier diode is presented, which determines the density of deep trap levels lying in the forbidden energy gap of epitaxial GaAs crystals. A novel feature of the technique is that it avoids the prior determination of the trap activation energy to determine the trap density. The method has been successfully applied to *n*-type vapour phase and liquid phase epitaxial GaAs crystals; the results are found to be in good agreement with those obtained with other well-established techniques. (5 refs.)

67812 Energy band-gap shift with elastic strain in Ga$_x$In$_{1-x}$P epitaxial layers on (001) GaAs substrates. H.Asai, K.Oe (Musashino Electrical Communication Lab., Nippon Telegraph & Telephone Public Corp., Tokyo, Japan).
J. Appl. Phys. (USA), vol.54, no.4, p.2052-6 (April 1983).
It is demonstrated that the energy band gap in epitaxial layers is changed by biaxial elastic strains which are produced by lattice mismatches in heterostructures. The epitaxial layers used in this work were Ga$_x$In$_{1-x}$P layers grown on (001) GaAs substrates by liquid phase epitaxy. The energy band-gap shifts were determined by comparing the photoluminescence peak energies of the as-grown Ga$_x$In$_{1-x}$P layers with those from free-standing layers removed from the GaAs substrates. It was experimentally found that the energy band gap shifts linearly with the elastic strain in the layer. Assuming that the lattice mismatch was accommodated only by the elastic distortion, the energy band-gap shifts in Ga$_{0.5}$In$_{0.5}$P alloys were also calculated. The calculated results are 6.0 eV or 4.9×10^{-12} eV/dyn cm^{-2} per unit strain or stress, respectively, for the [100] and [010] biaxial elastic stress. These values are in quite good agreement with the experimental results. (20 refs.)

67813 A study of impurities and traps in liquid phase epitaxial InP in relation to melt prebaking. J.K.Rhee, P.K.Bhattacharya (Dept. of Electrical & Computer Engng., Oregon State Univ., Corvallis, OR, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.700-3 (March 1983).
Deep- and shallow-level defects in liquid phase epitaxial InP have been detected and characterized by transient capacitance, Hall transport and photoluminescence measurements. The background impurity levels in the undoped crystals were varied by varying the period of prebaking of the In melt. A single deep electron trap with activation energy $\Delta E_T = 0.38 \pm 0.02$ eV is present dominantly with a concentration almost three orders lower than the background carrier concentration in the layers. From electron capture measurements, the electron capture cross section is found to obey the law $\sigma_n(T) = 4.78 \pm 10^{-15} \exp(-0.13/kT)$. The consistency of its concentration, irrespective of the purity of the crystal, and its removal after short-term heat-treatment leads the authors to believe that the trap is related to native defects. A hole trap with an activation energy of 0.22 eV was detected in some samples at low temperatures. (19 refs.)

67814 Evaluation and control of resistivity in N$^-$/N$^+$ epitaxial depositions. J.L.Sachitano, V.C.Kannan (Tektronix Labs., Tektronix Inc., Beaverton, OR, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.704-8 (March 1983).
Autodoping from 0.001 Ω-cm arsenic-doped silicon wafers interferes with the use of 10 Ω-cm P-type wafers for evaluating epi resistivities. A diffused layer is formed in the test wafers by arsenic atoms that evaporate from the N$^+$ wafers during the post-HCl bake prior to deposition. This layer leads to an erroneous four-point probe measurement of the epi-layer sheet resistance on the test wafer. A model is given that describes the formation of the diffused layer and its dependence upon the number of N$^+$ wafers. The model accounts for the epi resistivity as determined from the test wafer. A two-step epi procedure is described that allows the use of this type of test wafer for evaluating resistivities up to ≈30 Ω-cm. (19 refs.)

67815 Electronic properties of microcrystalline silicon prepared in the glow discharge plasma. W.E.Spear, G.Willeke, P.G.LeComber (Carnegie Lab. of Phys., Univ. Dundee, Dundee, Scotland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.908-13 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Reviews the preparation and structure of glow discharge microcrystalline Si and then deals in some detail with recent work on electronic properties. Conductivity, Hall effect and thermoelectric power measurements are discussed and it is concluded that crystalline semiconductor theory provides a consistent interpretation of the data. Field effect results confirm that in the microcrystalline phase the electron tail states of a-Si become de-localised. (26 refs.)

67816 Dependences of ESR and electrical properties on P doping ratio for microcrystalline Si. S.Hasegawa, S.Narikawa, Y.Kurata (Dept. of Electronics, Kanazawa Univ., Kanazawa, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.914-16 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The dependences of ESR, conductivity and X-ray diffraction profiles on P doping ratio are investigated for microcrystalline Si films. It is concluded that the tail state width in the amorphous phase portion is narrower than amorphous Si films, and the conductivity in the amorphous phase for the doped film largely increases over that in amorphous Si films as a result of a shift of the Fermi level to around 0.1 eV below conduction band. The crystalline size is about 200 Å and the mobility in the crystallite is consistent with that in crystalline Si. (10 refs.)

67817 Electronic transport in hydrogenated amorphous silicon. H.Overhof (Fachbereich Phys., Univ.-Gesamthochschule Paderborn, Paderborn, Germany), W.Beyer.
Philos. Mag. B (GB), vol.47, no.4, p.377-92 (April 1983).
The authors discuss various mechanisms proposed to explain the deviation of DC conductivity $\sigma(T)$ and thermopower $S(T)$ from an activated law. They confirm the result obtained by Emin (1977) that the variation of the band-gap with temperature leads to a modification of the transport parameters in addition to that caused by the statistical shift of the Fermi level. They demonstrate that, independent of doping and of the deposition conditions, all samples prepared by glow-discharge decomposition of SiH$_4$ exhibit a single transport mechanism, except for a possible hopping contribution. (34 refs.)

67818 Size anisotropy of the transverse magnetoresistance of epitaxial *n*-type GaAs films. M.G.Lukashevich, V.F.Stel'makh (V.I. Lenin State Univ., Minsk, Belorussian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1351-2 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2091-2 (Nov. 1982). [received: April 1983]
Investigates a manifestation of the size effect in the transverse magnetoresistance at 77K. The film thickness was varied using the layer-by-layer etching

method. The magnetoresistance was measured in a weak electric field and in magnetic fields up to 10 kOe in the n$\parallel$H configuration which gave $(\Delta\rho_\perp/\rho_0)_\parallel$, as well as in the n$_\perp$H configuration which yielded $(\Delta\rho_\perp/\rho_0)_\perp$, the angle ψ between normal **n** to the film surface and the magnetic field direction being unrestricted. Epitaxial films homogeneous over the surface area were grown on semiinsulating gallium arsenide substrates. Measurement of the physical magneto-resistance of epitaxial n-GaAs films at 77K is possible if the film thickness is a least 5 μm. Then, the experimental error (a reduction in the transverse magneto-resistance due to the size effect over the cooling length) does not normally exceed 20-30%. (5 refs.)

67819 Change in electrophysical properties of PbTe thin films under the action of oxygen. Yu.A.Boikov, V.A.Kutasov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1813-14 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3192-4 (Oct. 1982). [received: April 1983]
The authors study the kinetics of the variation of the properties of freshly deposited PbTe films when in contact with the atmosphere. A specially developed procedure made it possible to measure the electrical resistivity ρ, the Hall constant R_x, and the thermoelectromotive force α in the thin films at various temperatures (77-700K) in a high vacuum immediately after deposition and at a higher pressure right up to atmospheric. (4 refs.)

67820 The electrical properties of CuInSe$_2$ thin films deposited onto CaF$_2$ substrates. H.Neumann, E.Nowak (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany), G.Kuhn, B.Geise.
Thin Solid Films (Switzerland), vol.102, no.3, p.201-8 (22 April 1983).
CuInSe$_2$ thin films were deposited onto (111)-oriented CaF$_2$ substrates by flash evaporation in the substrate temperature range T_s=650-890K. Epitaxial growth was found at T_s=770-800K; at lower and higher substrate temperatures the films were partly polycrystalline. Films produced at $T_s \leq 675$K showed n-type conductivity due to a donor with an ionization energy of 78±5 meV ascribed to indium interstitials. At $T_s \geq 725$K the films exhibited p-type conductivity due to a shallow acceptor with an ionization energy characteristic of indium vacancies. The important role of the substrate material in establishing the electrical parameters of CuInSe$_2$ thin films is proved by a comparative study of thin films deposited onto GaAs and CaF$_2$ substrates. (26 refs.)

67821 Modulation of the electrical conductance of phthalocyanine films by circularly polarized light. T.W.Barrett (Chem. Div., Naval Res. Lab., Washington, DC, USA).
Thin Solid Films (Switzerland), vol.102, no.3, p.231-44 (22 April 1983).
The modulation of the electrical conductance by circularly polarized light of phthalocyanine films sublimed onto an interdigital electrode surface (metal/semiconductor/metal structure) is reported. The influence of bound oxygen in creating the p-type semiconductor behavior of the phthalocyanines has been investigated. The Fermi level of the phthalocyanine electrode system may be changed by circularly polarized light acting as an effective magnetic field in an inverse Faraday effect. (34 refs.)

67822 Anomalous temperature dependence of CdS film conduction due to oxygen diffusion and chemisorption. V.P.Panov, G.D.Sizova, V.N.Potapov.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.457-9 (March 1983). In Russian.
Investigates the mechanism of anomalous temperature dependence of conductivity in inhomogeneous chemically deposited CdS films in the temperature interval 10-300°C. The conductivity anomaly is observed only in an oxygen atmosphere and disappears during annealing in vacuum at 150-200°C. (10 refs.) *V.G.P.*

67823 Injection-stimulated blackening of As$_2$Se$_3$ films. B.S.Vakarov, L.E.Stys, M.G.Foigel', V.G.Tsukerman, L.V.Tsybeskov.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.463-5 (March 1983). In Russian.
Investigates the influence of injection on the spectral dependence of the photoconductivity of Au-As$_2$Se$_3$-Cr structures at T=0°C. The spectra shift towards the lower photon energy direction (darkening) is explained by the change in the spectral dependence of the absorption coefficient due to the recharging of deep centres in As$_2$Se$_3$. The results show that these centres are characterised by strong electron-phonon interactions. (5 refs.) *V.G.P.*

67824 Influence of light exposure on the transport properties of a-Si:H films. D.Hauschildt, W.Fuhs, H.Mell, K.Weber (Fachbereich Phys., Univ. Marburg, Marburg, Germany).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.448-53
The influence of strong illumination on the conductivity σ, thermopower S and field effect in glow discharge deposited a-Si:H-films is studied. The activation energies E_σ and E_S increase appreciably by exposure to light. Simultaneously the difference, E_σ-E_S, rises from ~0.1 to 0.21 eV. These changes anneal completely at temperatures above 170°C. The field effect data suggest that mainly defect levels near midgap are created, whereas no marked changes occur in the band tail region. The authors' results cannot be explained by models which assume that the samples are homogeneous. It is argued that transport takes place in extended states and that light exposure leads to an enhancement of spatial fluctuations of the mobility edge. These may arise from a strongly inhomogeneous distribution of charged defects. (15 refs.)

67825 Physical and electrical properties of polycrystalline silicon thin films. K.C.Saraswat (Integrated Circuits Lab., Stanford Univ., Stanford, CA, USA).
Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.261-74
Physical and electrical properties of chemically-vapor-deposited polycrystalline silicon films have been investigated. Effects of deposition parameters, doping, and high temperature processing on grain size and orientation, carrier concentration, carrier mobility and electrical resistivity, have been studied. By relating the physical and electrical properties to each other it has been shown that electrical conduction is controlled by dopant segregation, carrier tunneling, and trapping at grain boundaries. Models for these three mechanisms have been developed and by combining them a generalized model for electrical conduction has been developed. Presence of grain boundaries has also been shown to strongly influence the thermal oxidation and dopant diffusion in polycrystalline silicon. (23 refs.)

The influence of Bi on the lattice constant and the carrier concentration of PbTe .... See Entry 66942

Mass transfer of iron during doping of epitaxial layers of gallium arsenide .... See Entry 67022

The different roles of nitrogen in RF-sputtered and RF glow discharge hydrogenated amorphous silicon .... See Entry 67027

Current-assisted laser annealing of polysilicon films .... See Entry 67040

Effect of pulse laser emission on mercuric telluride .... See Entry 67042

Doping mechanism and properties of Zn-doped GaN-epitaxial layers .... See Entry 67381

Study of structural inhomogeneities in epitaxial layers of gallium arsenide .... See Entry 67392

Structure and photoelectric properties of films of solid solutions of the system Na(K)SbS$_2$-Sb$_2$S$_3$ .... See Entry 67393

Amorphous to microcrystalline transitions in Si films .... See Entry 67403

Transparent conductive films of tin oxide-preparation and properties .... See Entry 67407

Optical properties of deep centers in semi-insulating ZnSe .... See Entry 67539

Estimation methods for localized-state distribution profiles in undoped and phosphorous-doped *a*-Si:H .... See Entry 67543

Electrical properties of ion-implanted poly(*p*-phenylene sulfide) .... See Entry 67597

Correlation between electrical and vibrational properties of chlorinated and hydrogenated amorphous silicon prepared by glow discharge .... See Entry 67598

The electrical conductivity of amorphous antimony and its dependence on film thickness .... See Entry 67611

The DC conductivity of chalcogenide films due to the correlated barrier hopping mechanism .... See Entry 67612

Surface mobilities in laser-processed polysilicon films .... See Entry 67618

Grain boundaries in crystallized silicon thin films .... See Entry 67619

Measurement of high electron drift velocity in a submicron, heavily doped graded gap Al$_x$Ga$_{1-x}$As layer .... See Entry 67620

Effect of light intensity on photoconduction in amorphous selenium films .... See Entry 67682

Amorphous silicon-carbon-fluorine alloy films .... See Entry 67689

Intraband photoconductivity in coloured amorphous WO$_3$ films and intervalence transfer model .... See Entry 67692

Photoconductivity instability in thin polycrystalline CdS layers with high surface-charge density .... See Entry 67698

A thermophonic investigation of switching and memory phenomena in thick amorphous chalcogenide films .... See Entry 67711

Absorption in hydrogenated amorphous silicon at energies less than the optical band gap .... See Entry 68349

Electrical and photo-luminescence properties of ZnSe thin films grown by molecular beam epitaxy: substrate temperature effect .... See Entry 68440

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition .... See Entry 68448

Deposition and properties of zinc phosphide films .... See Entry 68454

Calculation of the efficiency of a polycrystalline gallium arsenide thin film solar cell .... See Entry 68867

73.60H Insulating thin films

67826 Effect of anodic growth temperature on native oxides of *n*-(Hg, Cd)Te. E.Bertagnolli, M.Bettini, E.Gornik (Inst. for Experimental Phys., Univ. of Innsbruck, Innsbruck, Austria).
Appl. Phys. Lett. (USA), vol.42, no.9, p.824-6 (1 May 1983).
The insulating behavior of anodically grown native oxides on Cd$_{0.23}$Hg$_{0.77}$Te can be improved considerably by performing the anodic process at increased temperatures. For the first time, anodic oxides were grown at 50°C in the standard ethylene glycol-KOH-electrolyte which show a reduction in the high-frequency (1 MHz) conductivity of the order of one magnitude respective to the room-temperature grown oxides. A high electrical breakdown voltage (1.5 MV/cm) and a decreased hysteresis shift (50 mV) underline these results. Other oxide parameters such as fixed oxide charges and fast surface states and the excellent DC resistivity remain practically unchanged. Subroom-temperature grown oxides, however, are extremely unstable. (14 refs.)

67827 Anomalous strain sensitivity of polycrystalline bismith antimony telluride films. Sh.B.Atakulov, T.Azimov, A.N.Shamsiddinov (M. Ulugbek State Pedagogical Inst., Fergana, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1326-7 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2053-5 (Nov. 1982). [received: April 1983]
The authors have carried out a detailed investigation of the structure and properties of bismuth antimony telluride films with anomalously high values of the strain sensitivity. These films were prepared by thermal condensation of (Bi, Sb)$_2$Te$_3$ in vacuum on substrates made of PM-1 polyimide. The film structure was studied with a scanning electron microscope. The current-voltage characteristics recorded at various temperatures and the results of structural investigations led to the following conclusion: the current in strain-sensitive (Bi, Sb)$_2$Te$_3$ films was confined to hollow channels present in the films and the transport of charge along them was due to the tunneling across the channels. (7 refs.)

Electrical and optical properties of polythiophene prepared by electrochemical polymerization .... See Entry 67556

Magnetochemical study of barium titanate doped with tantalum pentoxide .... See Entry 67592

Electron beam induced conductivity in 'PET' and 'FEP' .... See Entry 67646

The dielectric breakdown properties, current density-voltage and capacitance-voltage characteristics of ion-beam-synthesized Si$_3$N$_4$ layers .... See Entry 68129

73.60K Superconducting films

Investigation of the properties of superconducting niobium nitride films .... See Entry 67831

T_c measurement of sputter-deposited Nb$_3$Ge films by a balance-bridge method .... See Entry 67832

Enhancement of the superconducting transition temperature T_c in Nb$_3$Ge by the homoepitaxial technique .... See Entry 67837

Determination of the critical temperature of the ultrathin metals filaments superconducting transition and its dependence on the filament diameter .... See Entry 67839

Films and surfaces of ferromagnetic superconductors .... See Entry 67849

Topological excitations and specific-heat anomalies in 2D superconductors .... See Entry 67852

Temperature dependence of the excess resistance of a system of S-N boundaries .... See Entry 67858

Superconducting critical fields of copper in proximity with Nb-Ti .... See Entry 67860

Locked and unlocked phases of a two-dimensional lattice of superconducting vortices .... See Entry 67869

Ferromagnetic pinning of superconducting fluxoids at the contact between Sn and Gd films .... See Entry 67870

73.90 OTHER TOPICS IN ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS

67828 Exciton of surface helicons by the method of frustrated total internal reflection. N.N.Beletskii, V.N.Yakovenko (Sci. Res. Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1337-9 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2071-3 (Nov. 1982). [received: April 1983]
Assuming that surface helicons and Alfven waves are excited by the well-known method of frustrated total internal reflection (FTIR), the authors obtain the necessary expressions for the reflection coefficients and find the conditions under which volume electromagnetic waves are converted into surface waves at the boundary of a semiconductor plasma. (11 refs.)

74.00 SUPERCONDUCTIVITY

74.10 OCCURRENCE, CRITICAL TEMPERATURE

67829 Effects of high pressure-high temperature treatment on the structure composition and superconductivity of $Nb_3(Al,Ge)$. Zhao You-xiang, Liu Zhi-yi (Inst. of Phys., Acad. Sinica, Peking, China), Wang Shou-zheng, Guo Shu-quan.
Acta Phys. Sin. (China), vol.32, no.1, p.108-17 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Alloys of different nominal composition $Nb_3Al_{1-x}Ge_x$ (where $x=0.20$, 0.23, 0.25 containing $A15+\sigma$ phases) have been heat-treated under high pressure up to 67 kbar. With increasing treating pressure, (1) the lattice parameter of A15 phase as well as the I^{211}/I^{210} of relative integral intensity of X-ray diffraction peak (211) and (210) of A15 phase having some concern with structure composition both exhibits a maximum, (2) the structure composition of A15 phase shifts toward the Nb-rich direction, (3) the superconducting transition temperature T_c decreases, while the width of superconducting transition temperature range shows a maximum. (14 refs.)

67830 The superconducting-normal transitions of fast quenched supersaturated solid solution Al- at.% Ge alloy. Chen Xi-Sen, Wang Zu-Lun, Guan Wei-Yan (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.256-8 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The microstructure and superconducting-normal transitions of fast quenched supersaturated solid solution Al-1 at.% Ge alloy have been studied. X-ray structural analysis of the sample indicated that Al-1 at.% Ge alloy consisted of a homogeneous supersaturated *a*-Al(Ge) solid solution. The resistance measurement shows that for solid solution alloy *a*-Al(Ge) $T_c \approx 1.44K$, which is higher than that of pure Al. (7 refs.)

67831 Investigation of the properties of superconducting niobium nitride films. V.M.Pan, V.P.Gorishnyak, E.M.Rudenko, V.E.Shaternik (Inst. of Metal Phys., Kiev, Ukrainian SSR), M.V.Belous, S.A.Koziychuk, F.I.Korzhinsky.
Cryogenics (GB), vol.23, no.5, p.258-62 (May 1983).
Niobium nitride films with a value for T_c of up to 17.3K have been prepared by reactive magnetron and diode sputtering in Ar and N_2 gas mixture. Alteration of T_c and N_2 ion implantation into Nb-N films was studied. It is shown that small doses of implanted ions cause an abrupt decrease of T_c to 12.8K. Annealing at 900°C restores the high T_c. By the tunnel effect, the magnitude of the energy gap is 3.05 MeV at 1.56K for NbN with $T_c=17.1K$ and $2\Delta/kT_c=4.14$. The existence of an undersurface layer has been discovered, whose width is of the order of the coherence length, with a lower T_c of 12.0-12.8K. the superconductivity of this layer above T_c is due to the proximity effect. NbN tunnel junctions are made with a density of the Josephson current $j=(1.7\text{-}2.87)\times10^3 A\ cm^{-2}$. (7 refs.)

67832 T_c measurement of sputter-deposited Nb_3Ge films by a balance-bridge method. M.Suzuki, H.Ouchi, T.Anayama (Dept. of Electrical Engng., Tohoku Univ., Sendai, Japan).
Cryogenics (GB), vol.23, no.5, p.265-6 (May 1983).
T_c values of sputter-deposited Nb_3Ge films were measured using both the balance-bridge method and the four-probe resistance method. (4 refs.)

67833 Niobium: use in super-conducting alloys expands.
Int. J. Refract. & Hard Met. (GB), vol.2, no.1, p.8 (March 1983).
Discusses the nature of superconductivity and the usefulness of niobium alloys as superconductors. The manufacture of niobium alloys in Japan and elsewhere is described. The use of superconducting alloys in the prototype magnetic levitation train is briefly discussed. (no refs.)

67834 Kobe Steel develops niobium-base superconductor alloys.
Int. J. Refract. & Hard Met. (GB), vol.2, no.1, p.10 (March 1983).
The development of Nb-Ti-Ta-Zr and Nb_3Sn superconductors is discussed. The manufacturing processes are briefly described. Examples are given of the practical applications of superconducting magnets which use the new alloys. (no refs.)

67835 Effect of anharmonicity and Debye-Waller factor on the superconductivity of PdH_x and PdD_x. R.Griessen, D.G.de Groot (Natuurkundig Lab., Vrije Univ., Amsterdam, Netherlands).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.699-710 (1982).
On the basis of existing superconducting tunnelling, neutron scattering, electrical resistivity and Raman scattering data and new thermal expansion, elastic moduli and point-contact spectroscopy data it is concluded that the anharmonicity of the proton (deuteron)-palladium potential is such that $M_H\omega_H^2/(M_D\omega_D^2)=1.12\pm0.05$ ($M_{H(D)}$ is the mass and $\omega_{H(D)}$ the frequency of the vibration of hydrogen (deuterium)). This anharmonicity is approximately 2 times too weak to reproduce the observed inverse isotope effect in the superconducting transition temperature of concentrated PdH_x and PdD_x alloys. Within a pseudopotential formalism it is shown that the Debye-Waller factor arising from the large zero-point amplitude of the interstitial hydrogen (deuterium) leads to a contribution to the inverse isotope effect in T_c which is as large as that of anharmonicity alone. (32 refs.)

67836 Superconductivity of hydrides of $Nb_3Au_{0.75}Ir_{0.25}$ and $Nb_3Au_{1-x}Ge_x$. J.Elton, H.Oesterreicher (Dept. of Chem., Univ. of California, San Diego, La Jolla, CA, USA).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.L37-9 (April 1983).
Increases in the superconducting transition temperature T_c as a result of hydriding have been reported previously. In this study, materials are chosen such that under favorable circumstances (a variable hydrogen uptake) a similar increase should become possible. For this purpose $Nb_3Au(T_c\approx11K)$ was partly substituted by $Nb_3IR(T_c\approx2K)$ and $Nb_3Ge(T_c\approx23K)$. (9 refs.)

67837 Enhancement of the superconducting transition temperature T_c in Nb_3Ge by the homoepitaxial technique. Y.Kuwasawa, S.Nakano (Dept. of Phys., Chiba Univ., Chiba, Japan).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.447-9 (4 April 1983).
Nb_3Ge films grown homoepitaxially onto Nb-rich A15 Nb-Ge films have been prepared by the coevaporation method in UHV ($<10^{-6}$ Pa). These homoepitaxial films showed higher T_c and lower lattice parameters in an extended range of composition, 22.8-27.0 at.%Ge, compared with the films deposited directly onto sapphire substrates. (11 refs.)

67838 Semiconductor-superconductor transition in granular Al-Ge. Y.Shapira, G.Deutscher (Dept. of Phys. & Astron., Tel Aviv Univ., Tel Aviv, Israel).
Phys. Rev. B (USA), vol.27, no.7, p.4463-6 (1 April 1983).
The electrical resistance of granular Al-Ge specimens has been measured for various metal concentrations around the metal-insulator transition. The authors find that, in a narrow range of metal concentrations, the system is semiconducting in the normal state and yet undergoes a superconducting transition. It is shown that the occurrence of the semiconductor-superconductor transition is governed by the interplay between the intergrain tunneling coupling energy, the Josephson coupling energy, and the Coulomb charging energy, and is possible only for granular systems with large enough grains. (11 refs.)

67839 Determination of the critical temperature of the ultrathin metals filaments superconducting transition and its dependence on the filament diameter. V.N.Bogomolov, E.V.Kolla, Yu.A.Kumzerov (A.F. Ioffe Phys.-Tech. Inst., Leningrad, USSR).
Solid State Commun. (USA), vol.46, no.2, p.159-60 (April 1983).
Critical temperature (T_c) of ultrathin filaments (UF) was determined from UF resistance dependence on temperature, using a theoretical description of the fluctuation smeared superconducting transition. T_c vs. diameter (d) was measured for mercury and tin UF with diameters from 20 to 150 Å. The critical temperature of tin filaments increases with diameter decreasing (up to 5.2K) and $T_c(d)$ for mercury UF has a maximum ($T_c^{max}=4.6K$ for $d\simeq40$ Å). (5 refs.)

67840 Anomalous behavior of superconducting transition temperature of amorphous and crystalline Nb_3Ge under pressure. F.S.Razavi, J.S.Schilling (Inst. fur Experimentalphys. IV, Univ. Bochum, Bochum, Germany).
Solid State Commun. (USA), vol.46, no.2, p.197-9 (April 1983).
The superconducting transition temperature (T_c) of amorphous Nb_3Ge was studied under both hydrostatic and quasihydrostatic pressure to 3.5 and 13 GPa, respectively. Whereas hydrostatic pressure causes T_c to initially decrease, T_c is found to increase under higher quasihydrostatic pressures. $T_c(p)$ was also studied on an A-15 crystalline Nb_3Ge sample obtained from the amorphous sample by annealing. (17 refs.)

67841 Effects of a non-separable anisotropic pairing potential on the critical temperature. J.W.Blezius, J.P.Carbotte (Phys. Dept., McMaster Univ., Hamilton, Ontario, Canada).
Solid State Commun. (USA), vol.46, no.2, p.209-13 (April 1983).
Schachinger and Carbotte (1981) have found that a larger concentration of paramagnetic impurities is needed to reduce the critical temperature to zero in an anisotropic superconductor than would be required if the anisotropy was washed out by normal impurity scattering. In the large concentration regime where anisotropy becomes dominant, it is important to know whether the results of Schachinger and Carbotte depend sensitively on their use of a separable model for the anisotropy in the pairing interaction. To settle this question, the authors investigate a simple non-separable model and only minor differences are found. (9 refs.)

67842 The nature of the superconducting state in PbTe doped with thallium. I.A.Chernik, S.N.Lykov, N.I.Grechko (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1661-4 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2931-7 (Oct. 1982). [received: April 1983]
With the aim of explaining the nature of the superconductivity in PbTe(Tl), an experimental investigation is carried out on the linear term in the specific heat, low-temperature Hall coefficient, and critical temperature in PbTe samples containing thallium impurities (0.5 and 1.15 at %) with varying values of the Fermi energy due to doping with additional acceptor impurities (sodium). Analysis of the data indicates that a principal role is played by Tl impurity states in the formation of superconductivity in PbTe(Tl), that these states participate directly in the superconducting transition and that they make a definite contribution to the superconductivity. Also it is found that there is a threshold in the value of the Tl impurity concentration for superconductivity. Possible mechanisms of superconductivity in PbTe(Tl) are briefly discussed. (14 refs.)

Metal-nonmetal transition and superconductivity in amorphous $Si_{1-x}Au_x$ system .... See Entry 67709

Topological excitations and specific-heat anomalies in 2D superconductors .... See Entry 67852

Low temperature specific heat of ZrN_x [superconducting] .... See Entry 67853

Superconducting parameters of a strongly anisotropic intercalated TaS_2 compound: $K_{0.33}(H_2O)_{0.66}TaS_2$ .... See Entry 67868

Low temperature fatigue fracture of metals and alloys .... See Entry 68640

74.20 THEORY

Ginzburg-Landau expansion for copper pairs with nonzero angular momentum and analogy between spin glasses and Cooper pair system ...... See Entry 67929

74.20F BCS theory and its applications

Classical field descriptions of one-dimensional systems .... See Entry 67941

74.30 GENERAL PROPERTIES

67843 Size effect of the longitudinal resistivity of multifilamentary superconducting wires. C.Cavalloni, K.Kwasnitza, R.Monnier (Lab. fur Festkorperphys., ETH, Zurich, Switzerland).
Appl. Phys. Lett. (USA), vol.42, no.8, p.734-6 (15 April 1983).
Measurements on 22 different conductor samples, and numerical calculations based on Chambers' kinetic formulation show conclusive evidence for the existence of a substantial size effect on the longitudinal resistivity of multifilamentary superconducting wires in the normal state. This may have important consequences for the design of such conductors. (4 refs.)

67844 Influence of the normal phase concentration and morphology on the superconductor flow stress. V.I.Dotsenko, V.A.Sirenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.412-18 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The flow stress as a function of the normal phase concentration in superconductors has been studied. The essential differences in these dependences between types I and II superconductors that were found are associated with the normal phase morphology differences. (24 refs.)

67845 Size effects on electron transport in multifilament superconducting wires. C.Cavalloni, R.Monnier (Lab. fur Festkorperphys. ETH, Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.669-74 (1982).
Numerical results are presented for the longitudinal and transverse resistivity of multifilamentary superconducting wires in the normal state, as a function of the bulk mean free path in the matrix material, the radius of the filaments and the distance between them. Size effects are seen to play an important role in the range of parameters characteristic of technical superconductors. (8 refs.)

67846 Structure and magnetic properties of localised superconductive states. B.Ya.Shapiro (Inst. of Inorganic Chem., Acad. of Sci., Novosibirsk, USSR).
J. Phys. F (GB), vol.13, no.5, p.L83-7 (May 1983).
The magnetic properties of a space-inhomogeneous superconductor with plane metal inhomogeneities are investigated. The superconductive states are localised by an external magnetic field along the latter. Such localised states form a periodic space lattice with a square or triangular unit cell. (8 refs.)

74.30C Magnetization curves, Meissner effect, penetration depth

67847 Magnetic anisotropy in the organic superconductor $(TMTSF)_2ClO_4$. K.Andres, H.Schwenk (Walther-Meissner-Inst. fur Tieftemperaturforschung, Bayerischen Akad. Wissenschaften, Garching, Germany).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.675-87 (1982).
Electrochemically produced crystals of $(TMTSF)_2ClO_4$ grow with different morphologies, which exhibit different mechanical properties. The thinnest, needle-shaped samples prove to be particularly good single crystals and exhibit typical whisker properties. Measurements of the Meissner effect in the superconducting state of such crystals show high anisotropies both in the critical field and the 'pinning' force. (14 refs.)

67848 Spin density wave and superconductivity in highly anisotropic materials. IV. Electromagnetic properties of the coexistence phase. K.Machida (Dept. of Phys., Kyoto Univ., Kyoto, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1333-40 (April 1983).
The coexistence state of the spin density wave due to the itinerant electrons and superconductivity is further studied focusing on its electromagnetic properties within the same simple electron band model as used previously by the author. Anisotropic penetration depth and static electronic susceptibility are calculated. A brief discussion of recent far-infrared transmission experiments on $(TMTSF)_2ClO_4$ at low temperatures is given.

67849 Films and surfaces of ferromagnetic superconductors. M.Tachiki, T.Koyama, S.Takahashi (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.43-9 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The ternary compounds such as $(RE)Rh_4B_4$ and $(RE)Mo_6S_8$ contain magnetic rare earth ions RE at the regular lattice sites, nevertheless they show superconductivity. In the superconducting state of films and surfaces of these compounds, the interplay between magnetism and superconductivity causes the following unusual phenomena: the magnetization bound within the London penetration depth from the surface appears below a critical temperature. In the films various types of magnetic order coexisting with superconductivity appear depending on the film thickness. The anomalous behavior of the Josephson effect in ferromagnetic superconductors is briefly discussed. (18 refs.)

67850 Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$. H.B.Radousky (Materials Sci. Div., Argonne Nat. Lab., Argonne, IL, USA), A.T.Aldred, G.S.Knapp, J.S.Kouvel.
Phys. Rev. B (USA), vol.27, no.7, p.4236-42 (1 April 1983).
The magnetisation, susceptibility, heat capacity, and upper critical field (H_{c2}) versus temperature (T) curves have been determined for the $Y_{0.9}R_{0.1}Rh_4B_4$ system with R=Gd, Dy, Ho, Er, and Tm. These materials allow the effects of the different magnetic rare earths on the superconducting properties of the host material to be studied at a dilute concentration, where no long-range magnetic order has been observed. The Ginzburg-Landau parameters ξ_{GL} and λ_{GL} have been obtained from the values of the heat-capacity coefficient γ, $(dH_{c2}/dT)(T=T_c)$, and T_c. These parameters, which are derived from the data near T_c and at low fields, are relatively insensitive to the particular rare-earth ion. At higher values of $H/T(\approx 1$ kOe/K) the H_{c2}-vs-T curves show dramatic differences which can be correlated with the type of order (superconducting or ferromagnetic) that occurs in the RRh_4B_4 compounds. For R=Gd, Dy, and Ho, which order ferromagnetically in the concentrated compounds, the curves are seen to bend over sharply with increasing H/T, whereas for R=Er and Tm, which are superconducting in the concentrated compounds, the H_{c2}-vs-T curves are very similar to that of nonmagnetic YRh_4B_4. In addition, the critical-field curves show that the crystal fields strongly affect the response of the rare-earth ions in a magnetic field, which in turn determines the magnetic transition temperatures of the RRh_4B_4 compounds. (23 refs.)

Superconducting critical fields of copper in proximity with Nb-Ti .... See Entry 67860

Magnetic properties of voided superconductors in strong magnetic fields ($H \gtrsim H_{c2}$) .... See Entry 67867

Superconducting parameters of a strongly anisotropic intercalated TaS_2 compound: $K_{0.33}(H_2O)_{0.66}TaS_2$ .... See Entry 67868

74.30E Thermodynamic properties; thermal conductivity

67851 Kinetic properties of anisotropic superconductors with impurities. O.P.Bezzub, M.E.Palistrant.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.357-67 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The thermoelectric power η_s and the thermal electric conductivity K_s of a superconductor with paramagnetic impurities near the electronic topological transition (when a flattened spot appears on the Fermi surface) are studied theoretically. The equality of the ratio η_s/η_n and K_s/K_n in such systems is proved. The enhancement of the thermoelectric power by several orders at the electronic topological transition and the additional enhancement connected with electron exchange scattering on the impurity in superconductors are received. The possibility of the enhancement by several orders of magnetic flux Φ_T (connected with the temperature gradient) in a bimetallic loop is indicated. The ratio $\eta_s/\eta_n=K_s/K_n$ and the order parameter Δ/Δ_0 are found as functions of the pressure, concentration of impurity and temperature. (11 refs.)

67852 Topological excitations and specific-heat anomalies in 2D superconductors. C.Di Mauro (Centro Siciliano di Fisica Nucleare e di Struttura della Materia, Catania, Italy), G.Giaquinta.
Lett. Nuovo Cimento (Italy), vol.36, ser.2, no.16, p.539-43 (16 April 1983).
The authors show that the reconsideration of the specific heat data obtained by Rao et al. (1980) on amorphous Nb_3Ge superconducting thin films below T_c, and as yet uninterpreted in terms of the Kosterlitz-Thouless-Berezinskii transition phenomenon, leads to the recognition of the occurrences of vortex-antivortex pair dissociation in 2D superconductors low normal-state resistance. The authors' approach does not contain adjustable parameters. The differences between the calculated value of the Kosterlitz-Thouless-Berezinskii transition temperature (2.45K) and the value reported by Rao et al.(2.54K) is within the uncertainty limit (~3%). The characterisation of a phase transition through the temperature dependence of a static thermodynamic quantity is a more basic physical criterion than an as yet theoretically controversial nonequilibrium process. (31 refs.)

67853 Low temperature specific heat of ZrN_x [superconducting]. V.A.Lovchinov (Inst. of Solid State Phys., Sofia, Bulgaria), H.Madge, A.N.Christensen.
Phys. Scr. (Sweden), vol.27, no.3, p.207-10 (March 1983).
The low temperature specific heat of a series of ZrN_x samples (x=1.01; 0.93; 0.88; 0.74) has been measured in the temperature intervals 2-10 and 2-15K. For the superconducting samples, measurements in a magnetic field of 20 kOe were perfomed. Using the data, the coefficients of the electron specific heat γ, the Debye temperatures θ_D, the critical temperatures T_c, the density of states $N(0)$ at the Fermi level, the electron-phonon coupling terms λ, and the dependence of these parameters on the nitrogen concentration in the samples were determined. (12 refs.)

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ ...... See Entry 67850

74.30G Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation

Spin density wave and superconductivity in highly anisotropic materials. IV. Electromagnetic properties of the coexistence phase .... See Entry 67848

74.40 FLUCTUATIONS AND CRITICAL EFFECTS

Ten years of X-ray diffuse scattering studies of one-dimensional conductors and superconductors .... See Entry 67570

Determination of the critical temperature of the ultrathin metals filaments superconducting transition and its dependence on the filament diameter .... See Entry 67839

Locked and unlocked phases of a two-dimensional lattice of superconducting vortices .... See Entry 67869

74.50 PROXIMITY EFFECTS, TUNNELLING PHENOMENA, AND JOSEPHSON EFFECT

67854 Subharmonic generation in Josephson junction fluxon oscillators biased on Fiske steps. M.P.Soerensen, P.L.Christiansen, R.D.Parmentier, O.Skovgaard (Lab. of Appl. Math. Phys., Tech. Univ. of Denmark, Lyngby, Denmark).
Appl. Phys. Lett. (USA), vol.42, no.8, p.739-41 (15 April 1983).
Numerical integration of the perturbed sine-Gordon equation describing a long overlap-geometry Josephson junction in a magnetic field indicates a branched structure of the first Fiske step. The major portion of the step corresponds to a simply periodic fluxon oscillation whereas the branches are characterized by subharmonic generation. (9 refs.)

67855 Tunnelling between two superconductors separated by a double Schottky barrier. I.Janetka (CEFV SAV, Bratislava, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.2, p.93-104 (1983).
The tunnelling probability through tunnel junctions between two superconductors or metals separated by a double Schottky barrier is calculated in the WKB approximation. Further, the expression for the tunnel current is derived and its dependence on the applied voltage is numerically calculated for a Pb-CdS-Pb system at various temperatures. It is shown that the energy gap of superconductors (and mainly its changes, e.g. by temperature) can be measured not only from the steep increase of current at V-$2\Delta/e$, but also at larger voltages, determined by the appearance of the resonance tunnelling through the double barrier. (9 refs.)

67856 Frequency-dependent properties of a microbridge-coupled superconductor in a magnetic field of two frequency components. T.Ishida, H.Mazaki (Inst. for Chem. Res., Kyoto Univ., Kyoto, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L141-3 (March 1983).
Applying a mixing magnetic field $h_1 \sin 2\pi f_1 t + h_2 \sin 2\pi f_2 t$ to a microbridge-coupled Tc specimen, the authors have measured the AC susceptibility $\chi_1=\chi_1'-i\chi''_1$ through frequency channels of f_1 and f_2. Observations show the

f_2 dependence of χ''_1, where f_1 is fixed, i.e. the transitions in terms of $\chi''_1(f_1)$ and of $\chi''_1(f_2)$ occur at different temperatures. It has been revealed that the magnetic susceptibility approaches an asymptotic form as f_2 increases. (8 refs.)

67857 Macroscopic quantum tunnelling in Josephson junctions. A.A.Golub, V.P.Iordati.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.350-6 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The dissipation effect upon the macroscopic quantum tunnelling in Josephson junctions has been studied. It is shown that friction can lead to prolonged lifetime of metastable state of the junction. It is found that clear separation of pure quantum mechanical friction-free and dissipation-involving tunnelling probabilities is only possible for small friction. (14 refs.)

67858 Temperature dependence of the excess resistance of a system of S-N boundaries. Yu.G.Bevza, A.V.Lukashenko.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.368-72 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The authors propose a simple method to produce thin film structures with alternating superconducting and normal layers. The temperature dependence of the excess resistance of a system of *S-N* boundaries is studied. The version of the Artemenko-Volkov theory which allows for the conductivity difference between superconducting and normal metals is shown to be able to account for experimental results sufficiently well. (14 refs.)

67859 Electron-phonon interaction in superconducting contacts. V.A.Khlus, A.N.Omelyanchuk.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.373-84 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The current-voltage characteristic is found for the superconducting point contact whose size a is smaller than all the characteristic lengths $a \ll \xi(0)$, l, ${}^{v\mathrm{F}}/_{\omega \mathrm{D}}$ (l is the impurity-induced scattering length, $\xi(0)$-the superconducting coherence length). In the region of the site a near the contact where a strong electric field exists, quasi-particles emit nonequilibrium phonons. As a result, the current-voltage characteristic displays specific features connected with the position of the maxima of the electron-phonon interaction function $G(\omega)$ (an analogue of the Eliashberg function taking into account the contact geometry). The excess current existing at high voltages $eV \gg \Delta$ decreases with a growth of V, its derivative $dI_{\mathrm{ex}\odot}/dV$ being proportional to the function $G(\omega)$ which is somewhat different from the point contact function of the electron-phonon interaction for a normal contact. (13 refs.)

67860 Superconducting critical fields of copper in proximity with Nb-Ti. A.C.Mota, D.Marek, J.C.Weber (Eidgenossische Tech. Hochschule, Zurich, Switzerland).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.647-54 (1982).
The authors report the first measurements of magnetization curves of superconducting 10-20 μm thick copper in proximity with niobium-titanium. Very sharp first order transitions are observed at the breakdown fields H_b. From the temperature dependence of H_b, it seems that the pair penetration depth in copper is not limited by the electronic mean free path even at $T=5$ mK. (5 refs.)

67861 Frequency dependence of charge imbalance relaxation and boundary resistance at the superconductor-normal metal boundary. B.A.Mattoo, Y.Singh (Dept. of Phys., Univ. of Kashmir, Srinagar, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.938-41 (Dec. 1982). [received: April 1983]
Using the generalized two-fluid picture for the charge of a superconductor, the frequency dependence of the charge imbalance relaxation rate and the boundary resistance at the N-S interface are calculated. The former is in agreement with the result obtained by microscopic techniques. The latter shows a detectable effect in the microwave region. (16 refs.)

67862 Power dwell using vortex flow of long Josephson junctions. S.B.Kaplan (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.25, no.10, p.5065-7 (March 1983).
Shows that vortex flow in a long Josephson junction may be used to provide power dwell, needed to minimize the punchthrough problem, without the need for auxiliary circuits. (no refs.)

67863 Phonon spectrum analyzer. T.V.Rajeevakumar (IBM Corp., Armonk, NY, USA).
IBM Tech. Disclosure Bull. (USA), vol.25, no.10, p.5083-4 (March 1983).
Shows that phonons injected at one end of a superconductor are selectively attenuated under certain conditions related to their energy levels and the conditions of the superconductor, and thus an array of several superconductors with an array of differing related energy gaps may provide a wide-range phonon spectrum analyzer. (no refs.)

67864 Electronics poised for quantum leap. D.Madden.
Infomatics (GB), vol.4, no.4, p.44-5 (April 1983).
Describes the research work of a team of scientists at Sussex university which has produced results that threaten to revolutionalise conventional electronics. The team has built an artificial atom which exhibits the precise behaviour of a single atom implicit in the theories of quantum mechanics. These advances will enable physicists to investigate the behaviour of single atoms in different energy states (how atoms jump from one state to another) and could signal a new type of electronic circuitry within which signals travel faster than the speed of light. (no refs.)

67865 Microscopic quantum tunneling in Josephson junctions. A.A.Golub, V.P.Iordatii (Inst. of Appl. Phys., Acad. of Sci., Kishinev, Moldavian SSR).
JETP Lett. (USA), vol.36, no.6, p.227-30 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.184-7 (20 Sept. 1982). [received: April 1983]
The effect of dissipation on microscopic quantum tunneling in Josephson junctions is studied. It is shown that dissipation increases the lifetime of the metastable state of the junction. It is found that the tunneling probability can be clearly separated into quantum-mechanical tunneling in the absence of dissipation and dissipation-related tunneling only for small dissipation. (11 refs.)

67866 Measurements of g-factor and exchange integral J in $Hg_{1-x}Mn_xTe$ by means of tunneling. A.Okoniewski (Inst. of Phys., Tech. Univ. of Poznan, Poznan, Poland), J.Rauluszkiewicz.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.14-16 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
In dynamic conductivity dI/dV vs. V of tunnel junctions $HgMnTe/Al_2O_3/Pb$ the peaks at $V=0$ in low magnetic fields and the dips in higher fields are observed. These zero bias anomalies (ZBA) are interpreted in terms of interaction between tunneling electrons and magnetic moments of Mn ions. From the dependence of ZBA on magnetic field the g-factor vs. H and the exchange integral J have been deduced. (7 refs.)

Investigation of the properties of superconducting niobium nitride films ....See Entry 67831

Semiconductor-superconductor transition in granular Al-Ge .... See Entry 67838

Films and surfaces of ferromagnetic superconductors .... See Entry 67849

Electron spin polarized tunneling study of ferromagnetic thin films ....See Entry 67972

74.55 TYPE-I SUPERCONDUCTIVITY

Metal-nonmetal transition and superconductivity in amorphous $Si_{1-x}Au_x$ system .... See Entry 67709

74.60 TYPE-II SUPERCONDUCTIVITY

Niobium: use in super-conducting alloys expands .... See Entry 67833

74.60E Mixed state, H_{c2}, surface sheath

67867 Magnetic properties of voided superconductors in strong magnetic fields ($H \gtrsim H_{c2}$). V.N.Rud'ko, V.I.Sugakov.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.440-3 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The properties of superconducting regions localized near vacancy voids in type-II superconductors are investigated in the case of magnetic fields exceeding the second critical field. The dependence of the third critical field $H_{c3}(R)$ at which such regions appear on the void radius is obtained. This dependence is not monotonous, the amplitude of oscillations decreases when the void radius increases and $H_{c3}(R)$ tends to the plane surface value H_{c3}. Magnetic momentum caused by the appearance of superconducting regions also depends on magnetic field unmonotonously. It is shown that in the magnetic field range under consideration $(H)_{c2} < H < H_{c3}(R)$ the significant diamagnetic effect must be observed in real voided superconductors. (10 refs.)

67868 Superconducting parameters of a strongly anisotropic intercalated TaS_2 compound: $K_{0.33}(H_2O)_{0.66}TaS_2$. S.Gygax, W.Biberacher, A.Lerf (Walther Meissner Inst. fur Tieftemperaturforschung Bayerischen Akad. Wissenschaften, Garching, Germany), M.Denhoff.
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.755-63 (1982).
Electrochemically intercalated $K_{0.33}(H_2O)_{0.66}TaS_2$ crystals show a strong temperature dependent anisotropy of H_{c2} rising from 33 near T_c to well over 60 at lower temperatures. The coherence distances are determined to be $\xi_{\parallel}(0)=2.95 \times 10^{-6}$ cm and $\xi_{\perp}(0)=9.0 \times 10^{-8}$ cm. Penetration depths were estimated from low field measurements to be $\lambda_{\parallel}(0)=3.4 \times 10^{-4}$ cm and $\lambda_{\perp}(0)=7.1 \times 10^{-3}$ cm. An anomaly in the angular dependence of the entrance field H_{en} and trapped flux near parallel applied fields is found, qualitatively similar to what was observed in $NbSe_2$. (6 refs.)

Kobe Steel develops niobium-base superconductor alloys ....See Entry 67834

Magnetic anisotropy in the organic superconductor $(TMTSF)_2ClO_4$ ....See Entry 67847

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ ......See Entry 67850

Superconducting critical fields of copper in proximity with Nb-Ti ....See Entry 67860

74.60G Flux pinning; fluxon-defect interactions

67869 Locked and unlocked phases of a two-dimensional lattice of superconducting vortices. P.Martinoli, M.Nsabimana, G.A.Racine, H.Beck (Inst. de Phys., Univ. de Neuchatel, Neuchatel, Switzerland).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.655-8 (1982).
The flux lattice in a thin film of a type II superconductor, whose thickness is periodically modulated, allows for an investigation of various phase transitions typical of two-dimensional systems. The authors present a continuum approach in which the mismatch δ between the equilibrium lattice structure and the spacial period of the modulation plays a major role. In the ground state the lattice is locked by the modulation potential when δ is small, whereas for large enough δ the lattice is freely floating, its structure showing periodic discommensurations. A phase diagram in the (δ,T)-plane can be established by taking into account thermal fluctuations. Critical current data at various temperatures show good agreement with the theoretical predictions. (16 refs.)

67870 Ferromagnetic pinning of superconducting fluxoids at the contact between Sn and Gd films. R.Aoki, M.Katashiro (Dept. of Phys., Kyushu Univ., Fukuoka, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.17-18 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
To investigate the magnetic interaction of superconducting fluxoids with magnetic substances, coaxial multilayer samples are prepared by alternate deposition of two or three superconducting Sn or Pb (Tl) films of $2\text{-}3 \times 10^3$ Å and magnetic Gd or Y of $(4 \pm 1) \times 10^2$ Å. The measured superconducting critical current with perpendicular magnetic field H was enhanced more than ten times by the magnetic contact, and attained a value of 1.4×10^5 Acm^{-2} at $H=0.5$ kOe, $T=4.2$K for Pb (Tl). However, no significant difference in the effect between Gd and Y was observed. (5 refs.)

Magnetic anisotropy in the organic superconductor $(TMTSF)_2ClO_4$ ....See Entry 67847

Topological excitations and specific-heat anomalies in 2D superconductors ....See Entry 67852

Power dwell using vortex flow of long Josephson junctions .....See Entry 67862

Superconducting parameters of a strongly anisotropic intercalated TaS_2 compound: $K_{0.33}(H_2O)_{0.66}TaS_2$ .... See Entry 67868

74.60J Critical currents

67871 Influence of repeated heat treatment on critical current density of Nb-50 wt.%Ti alloy superconductors. A.Nagata, S.Hanada (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), S.Den, O.Izumi.
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.343-50 (April 1983). In Japanese.
The improvement of the critical current density (J_C) of a Nb-50 wt.%Ti alloy in high magnetic fields by means of repeated heat treatment and cold working has been studied from a metallurgical viewpoint. The cycle of heat treatment and working is found to be effective in improving J_C. The final drawing after intermediate heat treatment enhances J_C, especially in high magnetic fields. The fine dislocation network structure introduced by the final drawing

after heat treatment may be responsible for the increment of J_C in higher magnetic fields. (26 refs.)

Locked and unlocked phases of a two-dimensional lattice of superconducting vortices .... See Entry 67869

Ferromagnetic pinning of superconducting fluxoids at the contact between Sn and Gd films .... See Entry 67870

Mechanical and superconducting properties of Cu-Nb_3Sn in situ produced composite wires .... See Entry 68480

74.70 SUPERCONDUCTING MATERIALS

Size effect of the longitudinal resistivity of multifilamentary superconducting wires .... See Entry 67843

74.70D Material effects on T_c, K, critical currents

(see also 81.40R Electrical properties related to materials treatment)

Investigation of the properties of superconducting niobium nitride films .... See Entry 67831

Effect of anharmonicity and Debye-Waller factor on the superconductivity of PdH_x and PdD_x .... See Entry 67835

Superconductivity of hydrides of $Nb_3Au_{0.75}Ir_{0.25}$ and $Nb_3Au_{1-x}Ge_x$ .... See Entry 67836

Determination of the critical temperature of the ultrathin metals filaments superconducting transition and its dependence on the filament diameter .... See Entry 67839

Anomalous behavior of superconducting transition temperature of amorphous and crystalline Nb_3Ge under pressure .... See Entry 67840

Influence of repeated heat treatment on critical current density of Nb-50 wt.% Ti alloy superconductors .... See Entry 67871

Effect of non-magnetic impurities on the observation of superconducting gap excitations by Raman scattering .... See Entry 68210

74.70G Type-I superconductors (non transition metals)

Metal-nonmetal transition and superconductivity in amorphous $Si_{1-x}Au_x$ system .... See Entry 67709

Determination of the critical temperature of the ultrathin metals filaments superconducting transition and its dependence on the filament diameter .... See Entry 67839

74.70L Type-II superconductors (transition metals, alloys and compounds)

Low temperature phase diagram of the A15 compounds and the tetragonal-to-tetragonal phase transition of $Nb_2Sn_{1-x}Sb_x$ .... See Entry 67196

X-ray determination of the thermal expansion of Ti_3Au .... See Entry 67244

Lattice thermal expansion of Nb_3Os .... See Entry 67246

Molybdenum chalcogenides: clusters, chains, and extended solids. The approach to bonding in three dimensions .... See Entry 67501

Effects of high pressure-high temperature treatment on the structure composition and superconductivity of Nb_3(Al,Ge) .... See Entry 67829

The superconducting-normal transitions of fast quenched supersaturated solid solution Al- at.% Ge alloy .... See Entry 67830

Investigation of the properties of superconducting niobium nitride films .... See Entry 67831

T_c measurement of sputter-deposited Nb_3Ge films by a balance-bridge method .... See Entry 67832

Niobium: use in super-conducting alloys expands .... See Entry 67833

Kobe Steel develops niobium-base superconductor alloys .... See Entry 67834

Effect of anharmonicity and Debye-Waller factor on the superconductivity of PdH_x and PdD_x .... See Entry 67835

Superconductivity of hydrides of $Nb_3Au_{0.75}Ir_{0.25}$ and $Nb_3Au_{1-x}Ge_x$ .... See Entry 67836

Enhancement of the superconducting transition temperature T_c in Nb_3Ge by the homoepitaxial technique .... See Entry 67837

Anomalous behavior of superconducting transition temperature of amorphous and crystalline Nb_3Ge under pressure .... See Entry 67840

The nature of the superconducting state in PbTe doped with thallium .... See Entry 67842

Size effects on electron transport in multifilament superconducting wires .... See Entry 67845

Magnetic anisotropy in the organic superconductor $(TMTSF)_2ClO_4$ .... See Entry 67847

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ .... See Entry 67850

Topological excitations and specific-heat anomalies in 2D superconductors .... See Entry 67852

Low temperature specific heat of ZrN_x [superconducting] .... See Entry 67853

Superconducting parameters of a strongly anisotropic intercalated TaS_2 compound: $K_{0.33}(H_2O)_{0.66}TaS_2$ .... See Entry 67868

Influence of repeated heat treatment on critical current density of Nb-50 wt.% Ti alloy superconductors .... See Entry 67871

Induced ferromagnetism in $ErRh_4B_4$ .... See Entry 67924

Effect of non-magnetic impurities on the observation of superconducting gap excitations by Raman scattering .... See Entry 68210

Mechanical and superconducting properties of Cu-Nb_3Sn in situ produced composite wires .... See Entry 68480

74.70P Materials for high-field applications

Molybdenum chalcogenides: clusters, chains, and extended solids. The approach to bonding in three dimensions .... See Entry 67501

Kobe Steel develops niobium-base superconductor alloys .... See Entry 67834

75.00 MAGNETIC PROPERTIES AND MATERIALS

(see also 81.40R Magnetic properties related to materials treatment; for galvanomagnetic effects, see 72.15G and 72.20M; for magneto-optical effects, see 78.20L)

75.10 GENERAL THEORY AND MODELS OF MAGNETIC ORDERING

(see also 05.50 Ising problems, 71.25 Nonlocalized single-particle electronic states, 71.70 Level splitting and interactions)

Exact solution of the Anderson model: I .... See Entry 67416

Exact solution of the Anderson model. II. Thermodynamic properties at finite temperatures .... See Entry 67417

Self-localization of a conduction electron in magnetically ordered crystals .... See Entry 67503

75.10D Crystal-field theory and spin Hamiltonians

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction .... See Entry 67877

Magnetic susceptibility calculations from crystal field theory for high spin ferric complexes of tetragonal character .... See Entry 67901

Mossbauer spectroscopy on high-spin d^5 iron complexes: crystal field calculations .... See Entry 68095

75.10H Ising and other classical spin models

67872 **Random-field induced interface widths in Ising systems.** K.Binder (Inst. fur Festkorperforschung, KFA Julich, Julich, Germany).
Z. Phys. B (Germany), vol.50, no.4, p.343-52 (1983).
A d-dimensional Ising system with interaction J at zero temperature in random fields $\pm h$ is considered, where due to boundary conditions an interface between states of positive and negative magnetization is maintained over a cross-section L^{d-1}. The root mean square interface width $w(L, h)$ is found to behave as $w(L, h) \propto (h/J)^2 L (d=2)$ and $w(L, h) \leq L \exp [-\text{const}(J/h)^2]$ $(d=3)$. For $d=2$the interface energy is negative for $L \rightarrow \infty$, and hence domains form spontaneously. Nonzero temperatures are discussed qualitatively, and consequences for the interpretation of experiments on random-field systems are outlined. For $d=2$ and nonzero temperatures the author's treatment agrees with recent results of Grinstein and Ma (1982) and Villain (1982). (33 refs.)

67873 **Numerical solution of the mean-field theory of the ANNNI model in an external field: a comparison of two methods.** H.C.Ottinger (Fakultat fur Phys., Univ. Freiburg, Freiburg, Germany).
J. Phys. A (GB), vol.16, no.7, p.1483-9 (11 May 1983).
It is shown how the solution of the mean-field equations for the ANNNI model can be reduced to the iteration of an area-preserving two-dimensional mapping if an external magnetic field is applied. This method is analysed in detail and compared with the exact numerical solution of the mean-field equations for simple periodic magnetisations. (19 refs.)

67874 **The Yang-Lee edge singularity in one-dimensional Isung and N-vector models.** D.A.Kurtze (Phys. Dept., Carnegie-Mellon Univ., Pittsburgh, PA, USA).
J. Stat. Phys. (USA), vol.30, no.1, p.15-35 (Jan. 1983).
The distribution of zeros of the partition function in the complex magnetic field plane is studied for linear chains of n-vector spins and finite-width strips of Ising spins with nearest-neighbor interactions. By means of transfer matrix/operator techniques, the exponent σ characterizing the behavior of the density of zeros near the Yang-Lee edge is shown to have the exact value $\sigma=-1/2$ (i) analytically for n-vector chains in the high-temperature limit and for Ising strips in the low-temperature limit, and (ii) numerically for intermediate temperatures. The crossover of σ from its n-vector value to its spherical model value, $\sigma=1/2$, as $n \rightarrow \infty$, as well as from $d=1$ to $d=2$ Ising as the width of the strips increases, seems to proceed by an accumulation of branch points in the spectrum of the transfer operator; for the n-vector models the position of the gap edge and the free energy at the edge approach their spherical model values with corrections of order $1/n^{\zeta}$ with $\zeta \simeq 3/4$. (32 refs.)

67875 **The isothermal and frequency-dependent perpendicular susceptibilities of the one-dimensional alternating Ising model.** L.L.Goncalves (Dept. de Fisica, Univ. Federal do Ceara, Ceara, Brazil).
Solid State Commun. (USA), vol.46, no.5, p.375-7 (May 1983).
Exact expressions for the isothermal and frequency-dependent perpendicular susceptibilities are obtained for the alternating Ising model in an external longitudinal field. It is shown that even for vanishing field the isolated perpendicular susceptibility is identical to the isothermal one. It is also obtained the longitudinal wave-vector dependent susceptibility, and the results are compared with the known ones. (8 refs.)

The Oguchi approximation is exact for infinite-dimensional lattices .... See Entry 64847

Classical field descriptions of one-dimensional systems .... See Entry 67941

Phase separations in Ising model with free boundary condition .... See Entry 67943

Comparison of different boundary conditions for Monte Carlo simulations of Ising models .... See Entry 67944

Residual entropy of the one-dimensional Ising antiferromagnet with general spin .... See Entry 67945

75.10J Heisenberg and other quantized localized spin models

67876 **The constant-coupling approximation: some exact results.** J.Katriel, G.F.Kventzel (Dept. of Chem., Technion-Israel Inst. of Technol., Haifa, Israel).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K51-6 (1 March 1983).
The limiting behaviour of the constant coupling approximation (CCA), as $z \rightarrow \infty$, is examined in full generality, establishing rigorously that it reduces to the Weiss-Heisenberg (WH) theory. Furthermore, the behaviour of the effective field is examined and some of its properties are derived. In particular, the

limiting behaviour as T→0 and as $T \to T_c$ is investigated, and some results are obtained in an analytic form. These results are preceded by a concise statement of the principal equations of the CCA. (16 refs.)

Linked cluster expansion for quantum spins ....See Entry 67946

Monte Carlo study of a Heisenberg antiferromagnet on an FCC lattice with and without dilution ....See Entry 67947

Effects of biquadratic exchange interaction on dynamic susceptibility in Heisenberg ferromagnet ....See Entry 67948

75.10L Band and itinerant models

67877 Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction. A.I.Mitsek, K.Yu.Guslienko, S.V.Pavlovskii (Inst. of Metal Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1570-4 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2773-81 (Sept. 1982). [received: April 1983]
The energy spectrum of electrons in narrow bands of transition elements, in particular, rare-earth metals, are calculated within the framework of many-body theory. The Hubbard intraatomic Coulomb repulsion, an anisotropic crystal field, and the exchange and Zeeman energies are considered. The positions of many-electron energy bands and their widths are evaluated using an effective spin Hamiltonian. The separation between the bands and the dispersion law of electrons are determined by the total angular momentum J of the electron shell of a rare-earth atom and by the projection m of the total angular momentum $\mathbf{J}_f$ on the quantization axis. The width of a band is proportional to m and to an exchange integral I. Interband transitions are associated with excitons, magnons, and multiplet waves. Magnetic phase diagrams are determined for various signs of the coefficient K_1 of an irreducible tensor operator of the lowest order (the magnetic anisotropy constant K_1 of a uniaxial crystal containing rare-earth elements). The magnetization curves in the limit of a weak exchange (compared with the anisotropy) are calculated. It is shown that the magnetization curves are continuous for an arbitrary orientation of the magnetic field. It is predicted that the relative spontaneous magnetization exhibits an oscillatory dependence on the number of magnetic electrons (on J). Saturation orientation phase transitions and order-disorder transitions are also studied in the mean-field approximation. (27 refs.)

Virtual bound state model for the exchange interaction in semimagnetic semiconductors such as $Cd_{1-x}Mn_xTe$ ....See Entry 67914

Classical field descriptions of one-dimensional systems ....See Entry 67941

75.20 DIAMAGNETISM AND PARAMAGNETISM

67878 Temperature dependence of the magnetic susceptibility of almost-ferromagnetic materials. D.R.Grempel (Dept. of Phys., Univ. of Maryland, College Park, MD, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4281-7 (1 April 1983).
Presents a microscopic calculation of the magnetic susceptibility of exchange-enhanced materials based on the paramagnon model for the interaction of electrons with spin fluctuations. By explicitly calculating the vertex corrections, the author finds that, in a spin-conserving approximation, the low-temperature magnetic susceptibility contains anomalous logarithmic corrections that account for the maximum in $\chi(T)$ observed in many materials. This is the result expected on the basis of phenomenological Landau theory. The results, which are not limited to low temperatures, show that at temperatures above the spin-fluctuation temperature the inverse susceptibility increases almost linearly with T, in agreement with spin-fluctuation theories. (13 refs.)

67879 Field dependences of magnetisation and specific heat coefficient in a nearly magnetic system: Liquid ^{3}He and strong Pauli paramagnets. M.T.Beal-Monod, E.Daniel (Lab. de Phys. des Solides, Univ. de Paris-Sud, Orsay, France).
Phys. Rev. B (USA), vol.27, no.7, p.4467-70 (1 April 1983).
The authors analytically derive the first-order magnetic field dependences of the magnetisation M and of the coefficient γ of the specific heat, in a nearly magnetic paramagnet, at low temperature. (17 refs.)

Absorption of ultrasound in diamagnets containing paramagnetic impurities ....See Entry 67119

75.20C Nonmetals

67880 Influence of magnetic field on the development of magnetic anisotropy in a magneto-electret of shellac wax. M.L.Maji, S.D.Chatterjee (Dept. of Phys., Jadavpur Univ., Calcutta, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.986-7 (Dec. 1982). [received: April 1983]
Fluctuation of magnetic anisotropy as a function of the forming magnetic field has been observed, in a shellac wax magneto-electret. It has been explained by the existence of paramagnetic anisotropy developed by trapped ions in the magneto-electret state together with the diamagnetic anisotropy of the molecules. (10 refs.)

67881 Magnetic properties of solid solutions of the system β-USe_2-UTe_2. A.V.Pechennikov, V.K.Slovyanskikh, V.I.Chechernikov, N.T.Kuznetsov, N.V.Gracheva, V.M.Golubev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.5, p.738-9 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.877-9 (May 1982). [received: Feb. 1983]
Presents the results of a study of the magnetic properties of solid solutions of $USe_{2-x}Te_x$ and the compounds UTe_2 and β-USe_2. The magnetic susceptibility was studied in the temperature interval 77-600K. The variation in the magnetic susceptibility of the solid solution $USe_{2-x}Te_x$ follows the Curie-Weiss law. From graphs of the dependence of $1/\chi$ on T (where χ is the paramagnetic susceptibility and T is the temperature in K), the authors determined the paramagnetic Curie temperature θ_p and the effective magnetic moment μ_{eff} at the uranium atom. (8 refs.)

67882 The γ-α transition in cerium compounds. M.Lavagna, C.Lacroix, M.Cyrot (Lab. Louis Neel, CNRS, Grenoble, France).
J. Phys. F (GB), vol.13, no.5, p.1007-15 (May 1983).
The γ-α transition and the related volume collapse are explained within a compressible Kondo lattice where the variation of $|J|/D$ with volume is taken into account. The authors show that, contrary to the promotion model, the Kondo contribution is sufficient to induce a first-order transition at low temperature from a magnetic to a Kondo phase. The α phase is then characterised by an extremely high Kondo temperature. The calculations are also made at zero and finite temperatures and the existence of a critical point is demonstrated. Finally, they propose a generalisation to the effect of a chemical pressure. Applications are made to Ce, $CeAl_2$ and $Ce_{1-x}Th_x$. (21 refs.)

67883 Magnetic properties of thorium and uranium borides and $U_{1-x}Th_xB_4$ solid solutions. Z.B.Chachkhiani, L.G.Chachkhiani, V.I.Chechernikov, V.K.Slovyanskikh (V.I. Lenin Polytech. Inst., Georgian SSR).
Sov. Phys. J. (USA), vol.25, no.7, p.621-8 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.45-8 (July 1982). [received: May 1983]
The dependence of the magnetic susceptibility on the temperature in the compound UB_4 and system $U_{1-x}Th_xB_4$ has been studied in the temperature range 140-1300K. It has been established that the paramagnetic susceptibility does not obey the Curie-Weiss law. The experimental results are interpreted on the basis of the Stoner model of collectivized electrons which also makes it possible to explain the magnetic properties of other borides of thorium and uranium. (15 refs.)

Magnetic properties and structure of ternary system glasses ..See Entry 66892

Electronic structures of higher stage graphite intercalation compounds ....See Entry 67420

Valence change of Sm ion in $Eu_{1-x}Sm_xSe$ ....See Entry 67547

The electronic and magnetic properties of transition metal dichalcogenide intercalation complexes ....See Entry 67572

Amorphous barium vanadates doped with transition metals .....See Entry 67610

High temperature magnetic susceptibility of the Nb-H system ....See Entry 67885

Spin dependent effects in semimagnetic semiconductors ....See Entry 67938

Magnetic characteristics of La_5Ge_3, Ce_5Ge_3, Pr_5Ge_3 ....See Entry 67968

Paramagnetic and electric geometric resonances in antiferromagnetic semiconductors ....See Entry 68038

Measurement of ^{1}H Knight shift and magnetic susceptibility in compressed powder samples of $TaH_{0.61}$ ....See Entry 68057

The nature of the Faraday effect in the paramagnetic rare earth garnet $Tb_3Ga_5O_{12}$ ....See Entry 68185

Preparation of TlP_xS_{1-x} and investigation of physicochemical properties ....See Entry 68423

Synthesis and properties of $La_{1-x}K_xVO_3$ solid solutions with the perovskite structure ....See Entry 68465

75.20E Metals and alloys

67884 Vector potential induced diamagnetism and flux quantization in normal metals. E.N.Bogachek, I.O.Kulik.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.398-402 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
Diamagnetic susceptibility of a bulk normal metal single crystal with cylindrical cavity is shown to oscillate as a function of magnetic flux penetrating the cavity $\Phi = HS$ (S being the cross section of the cavity) perpendicular to H with the period $\Phi_0 = hc/e$. Similar effects take place if a small solenoid producing vector potential field in the metal is inserted inside the cavity. The magnitude of the oscillating component of the magnetic moment in the metal is of the order of magnitude $(\Phi_0/HR_0{}^2)\ M_{\mathrm{HVA}}{}^{\mathrm{OC\Pi}}$ where $M_{\mathrm{HVA}}{}^{\mathrm{OC\Pi}}$ is the magnitude of the de Haas-van Alphen effect and R_0 the sample diameter. (14 refs.)

67885 High temperature magnetic susceptibility of the Nb-H system. J.-M.Welter (Inst. fur Festkorperforschung, KFA, Julich, Julich, Germany), H.Lilienthal.
J. Less-Common Met. (Switzerland), vol.90, no.2, p.291-7 (April 1983).
The magnetic susceptibility $\chi(T,x)$ of various NbH_x specimens with $0 \le x \le 0.8$ was measured in the temperature range $275K \le T \le 475K$. The susceptibility of the solid solution decreases from 2.84×10^{-5} to 1.25×10^{-5} $cm^3\ g^{-1}$ in this hydrogen concentration range and exhibits a marked break at $x \approx 0.6$. An estimate of the Pauli paramagnetic spin susceptibility χ_P for the two limiting concentrations allowed the evaluation of the orbital paramagnetic susceptibility χ_O. For $x=0$ and $x \approx 0.8$ the values of χ_P are 1.05×10^{-5} $cm^3\ g^{-1}$ and 0.39×10^{-5} $cm^3\ g^{-1}$ respectively and the values of χ_O are 1.73×10^{-5} $cm^3\ g^{-1}$ and 1.08×10^{-5} $cm^3\ g^{-1}$ respectively. The magnetic susceptibility decreases by approximately 10% on going from the concentrated solid solution to the monohydride. (23 refs.)

67886 Disordered local moment state of magnetic transition metals: a self-consistent KKR CPA calculation. A.J.Pindor (Cavendish Lab., Cambridge Univ., Cambridge, England), J.Staunton, G.M.Stocks, H.Winter.
J. Phys. F (GB), vol.13, no.5, p.979-89 (May 1983).
The authors perform self-consistent KKR CPA calculations for the disordered local moment (DLM) state of Fe, Co, Ni and Cr at different temperatures. The DLM state is a model for the metals above their Curie temperatures, in the paramagnetic state. They find the dependence of the local magnetic moment on temperature and determine the Stoner temperature. For Fe, they obtain the magnitude of the local moment above the Curie temperature to be about 85% of the ground-state value, whereas for Co and Ni it is about 50% of the ground-state value. For Cr they find that no self-consistent local magnetic moment exists in this DLM state. With slightly increased lattice spacing the sizes of the local moments are found to increase for both Fe and Ni. (21 refs.)

67887 A real-space method for the calculation of the orbital susceptibility of simple metals and transition metals. J.Benkowitsch, H.Winter (Kernforschungzentrum Karlsruhe, Karlsruhe, Germany).
J. Phys. F (GB), vol.13, no.5, p.991-1005 (May 1983).
A real-space method for the calculation of the orbital susceptibility, χ_0, of electrons in metals is developed. The authors express this quantity in terms of integrals over the spatial arguments of correlation functions and write χ_0 as the sum of the following three contributions: the Langevin diamagnetism, the Van Vleck paramagnetism and a term which yields the Landau diamagnetism in the limit of free electrons. The evaluation of χ_0 for the free-electron gas as a test case for the Al, Nb, V and Mo demonstrates its applicability to both simple and transition metals. In this work the Landau term for transition metals is calculated separately for the first time. They show that it provides an appreciable paramagnetic contribution in the cases of Nb and V. (36 refs.)

67888 Magnetic susceptibilities of liquid binary alloys. M.Iwamatsu, S.K.Lai, R.A.Moore, S.Wang (Univ. of Waterloo, Waterloo, Ontario, Canada).
J. Phys. F (GB), vol.13, no.5, p.1027-40 (May 1983).
A description of the concentration dependence of the magnetic susceptibilities of a number of liquid binary alloys of simple metals is effected in three stages. First, a previous pseudopotential formalism is extended to enable the calculation of the conduction electron diamagnetic susceptibilities in the pure liquid metals, Li, Na, K, Rb, Cs, In and Pb. These results are then combined

with much earlier calculated values of the diamagnetic susceptibilities of the core electrons and with observed values, existing in the literature, of the total magnetic susceptibilities to infer the conduction electron paramagnetic susceptibilities of the above pure liquid metals. Second, the expressions for the two diamagnetic contributions are modified permitting the determination of their concentration dependence in a number of nearly-free-electron (NFE) like liquid binary alloys. The Landau theory of a Fermi liquid is used to infer the concentration dependence of the paramagnetic contribution. Third, Li-Pb, which is not NFE like over the entire concentration range is treated separately as a special but closely related case. The observed results for the concentration dependence of the total magnetic susceptibility are favourably reproduced, both for those alloy systems exhibiting smooth variations and for those with large variations. (34 refs.)

67889 Unusual paramagnetism of FeSi: experiment. H.Miyajima.
Solid State Phys. (Japan), vol.18, no.1, p.1-12 (Jan. 1983). In Japanese.
The magnetic properties of FeSi are reviewed from experimental points of view. It is also shown that most of them can be explained by using spin fluctuation theory developed by Moriya (1978) and others. (50 refs.)

67890 Unusual paramagnetism of FeSi: theory. Y.Takahashi.
Solid State Phys. (Japan), vol.18, no.1, p.13-18 (Jan. 1983). In Japanese.
The magnetic properties of FeSi are briefly reiewed from theoretical points of view with particular attention paid to the temperature induced local moment at high temperature. (15 refs.)

Magnetic properties of $Ni_{0.8}Cu_{0.2-x}Zn_x$ alloys ....See Entry 67902

Conversion electron Mossbauer spectroscopy and LEED on epitaxial γ-Fe thin films grown on Cu(100) ....See Entry 68097

75.20H Local moment in dilute alloys; Kondo effect

(see also 72.15Q Electronic conduction)

67891 The double impurities scattering theory for 'the resistance maximum' phenomena in the dilute magnetic alloys. Wang Chung-chen, Liu Fu-siu (Dept. of Phys., Peking Univ., Peking, China).
Acta Phys. Sin. (China), vol.32, no.1, p.33-45 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Based on s-d interaction, the authors consider RKKY interaction existing between two magnetic impurities, and propose a new double impurities scattering model. According to this model, when an impurity spin makes spin flip scattering, its spin as an inner free degree will be confined by other impurities' spin, where the RKKY correlation exists between them. Because of this correlation, it will suppress its spin flip scattering. This suppression, coupled with the Kondo log$T$ term, causes a local maximum. They have calculated all possible 'DIS' diagrams (the double impurities self-energy diagrams) and found a term $A/(T_0{}^2-T^2)$ contribute to the Kondo resistance, where A is a positive constant, T_0 is some critical temperature. When $T\leq T_0$, this formula is meaningless. (19 refs.)

67892 Simple scaling behaviour in the magnetic susceptibility of $CeSn_3$ under high pressure. S.A.Shaheen, J.S.Schilling (Experimentalphys. IV, Univ. Bochum, Bochum, Germany), S.H.Liu, O.D.McMasters.
Phys. Rev. B (USA), vol.27, no.7, p.4325-35 (1 April 1983).
The static magnetic susceptibility χ of single-crystalline $CeSn_3$ is measured as a function of temperature $3\leq T\leq 300K$ and hydrostatic pressure 1 bar$\leq P\leq 15$ kbar. The temperature and pressure dependence of χ is shown to be a function of a single characteristic spin-fluctuation energy kT_{sf}, i.e. χT scales with T/T_{sf}. From the magnitude of the increase of T_{sf} with pressure ($\partial \ln T_{sf}/\partial P\simeq +1.4\%$/kbar or $\partial \ln T_{sf}/\partial \ln V\simeq -7.6$) it can be indirectly inferred within a simple model that an increase in the 4f hybridisation width Δ, rather than a decrease in the 4f binding energy ϵ_{ex}, is the dominant change in the magnetic state under pressure. These results imply that $CeSn_3$ would be best characterised as a trivalent Ce compound with a rather high spin-fluctuation temperature ($T_{sf}\simeq 200K$) rather than as a compound with fractional valence. $\chi(T)$ appears to depend only very weakly on the relative orientation of the magnetic field. The Curie tail in $\chi(T)$ below 20K is independent of pressure and is, therefore, very likely an impurity effect rather than an intrinsic property of the compound. It is suggested that scaling itself can be used to derive changes in both the valence v and T_{sf} in a single experiment. (37 refs.)

Localized magnetic moments in $Bi_{1-x}Sb_x$ semiconductor alloys ....See Entry 67661

Unusual paramagnetism of FeSi: theory ....See Entry 67890

Integrability of a one-dimensional Fermi system with magnetic impurities ....See Entry 67917

75.25 SPIN ARRANGEMENTS IN MAGNETICALLY ORDERED MATERIALS (NEUTRON STUDIES, ETC)

67893 Magnetic defects in antiferromagnetically ordered $Mn_{1-n}Zn_nF_2$ mixed fluorides. E.Bakshi, T.J.Hicks (Dept. of Phys., Monash Univ., Clayton, Victoria, Australia).
J. Phys. C (GB), vol.16, no.12, p.2337-50 (30 April 1983).
The authors have measured magnetic diffuse elastic cross sections for the $Mn_{1-n}Zn_nF_2$ system at 4.2K and for one composition at 25K. Neutron polarisation analysis with a time-of-flight technique was used to separate the magnetic elastic cross section. Most magnetic disturbance appears on next-nearest-neighbour manganese atoms to the Zn impurity and is greater than would be expected from Lovesey and Marshall's model of very dilute alloys (1966). The range of the disturbance increases at higher temperatures. (16 refs.)

67894 Magnetic structure and magnetic properties of non-stoichiometric $Fe_{1-x}O$. M.Akimitsu, T.Mizoguchi (Dept. of Phys., Gakushuin Univ., Tokyo, Japan), S.Kimura.
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.497-505 (1983).
The magnetic structure of non-stoichiometric $Fe_{1-x}O$ was investigated by neutron scattering measurements on a quenched single crystal of $Fe_{0.91}O$ below the Neel temperature. In each defect cluster, there exist ferromagnetic moments and they are arranged antiferromagnetically with a periodicity of twice that of the atomic superstructure. The relation between the defect structure and the magnetic properties for a wide range of compositions was discussed. (14 refs.)

67895 Isomorphic MeX_2O_4 compounds: anisotropic thermal expansion and magnetic order in $MnSb_2O_4$. J.R.Gavarri, G.Calvarin, B.Chardon (Lab. de Chimie-Phys. du Solide, Univ. Paris XIII, Chatenay-Malabry, France).
J. Solid State Chem. (USA), vol.47, no.2, p.132-42 (April 1983). In French.
Using X-ray diffraction data, the anisotropic thermal expansion coefficients α_a and α_c of two isomorphic compounds $MnSb_2O_4$ and $NiSb_2O_4$ are linked to the anisotropic elastic constants of these tetragonal structures and compared to the $ZnSb_2O_4$, $SnPb_2O_4$ thermal expansion coefficients. The anomalous thermal expansion observed for $MnSb_2O_4$ in the 6-115K range (maximum of α_c at 70K) is related to the ordering of Mn^{2+} ion magnetic moments. Using neutron diffraction, two kinds of antiferromagnetic order are observed for $MnSb_2O_4$ and $NiSb_2O_4$. At 6K the value of the resultant moment is approximately 1.8 μ_B for $NiSb_2O_4$ and 3.8 μ_B for $MnSb_2O_4$. A critical temperature of $T_c=115K$ is proposed for $MnSb_2O_4$ based on the use of X-ray diffraction data alone. (18 refs.)

67896 Surface-induced ordered magnetism in Mo and W and surface magnetic structures. Y.Teraoka (Dept. of Phys., Univ. of Osaka Prefecture, Sakai, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.19-21 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The possibility of the appearance of a surface-induced ordered magnetism on surfaces of Mo and W is discussed by use of the tight-binding model within the Hartree-Fock approximation and a surface magnetic structure with the lowest energy is discussed. (7 refs.)

67897 Short range antiferromagnetic ordering in fluoride glasses '$PbMnFeF_7$' and 'Pb_2MnFeF_9'. A.Le Bail, C.Jacoboni, R.De Pape (Lab. des Fluorures et Oxyfluorures Ioniques, Univ. du Maine, Le Mans, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.677-80 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Neutron diffraction and EXAFS experiments have been made on fluoride glasses '$PbMnFeF_7$' and 'Pb_2MnFeF_9' to provide informations about the magnetic short range order of pairs M-M ($M=Mn^{2+}$, Fe^{3+}) and the local environment of Mn^{2+} and Fe^{3+}. The magnetic correlation function shows in both glasses prevailing strong antiferromagnetic first neighbour interaction at 3.6 Å and two ferromagnetic interactions at 5.4 and 6.7 Å. EXAFS results confirm the expected sixfold coordination of Mn^{2+} and Fe^{3+}. The structure of these glasses is described in terms of randomly linked corner shared MF_6 octahedra chains with Pb^{2+} in interstitial sites. (13 refs.)

Induced ferromagnetism in $ErRh_4B_4$ ....See Entry 67924

Neutron-diffraction study of the structural and magnetic phase transitions in manganese selenide ....See Entry 67926

Magnetic satellites in mictomagnetic CuMn ....See Entry 67933

Mossbauer and X-ray study of $FeP_{0.85}Si_{0.15}$ ....See Entry 68101

75.30 MAGNETICALLY ORDERED MATERIALS, OTHER INTRINSIC PROPERTIES

(for critical point effects, see 75.40)

75.30C Saturation moments and magnetic susceptibility

67898 Quasi-ferromagnetism in antiferromagnetic $GdVO_4$. K.Gaur, A.K.Tripathi, H.B.Lal (Dept. of Phys., Univ. of Gorakhpur, Gorakhpur, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.161-2 (April 1983).
The authors report the magnetic susceptibility and magnetisation behaviour of $GdVO_4$ above room temperature. Its behaviour is found to be like a typical ferromagnetic material in the range 300 to 900K and is unique. An hypothesis is proposed to explain this behaviour. (7 refs.)

67899 Magnetic susceptibility of $La_{1-x}Nd_xTlO_3$ system ($0.0\leq x\leq 1.0$) [and synthesis and X-ray characterisation]. B.N.Tiwari, P.N.Ojha (Dept. of Chem., Univ. of Gorakhpur, Gorakhpur, India).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.163-5 (April 1983).
$La_{1-x}Nd_xTlO_3$ ($x=0.2$, 0.5, 0.8 and 1.0) phases were synthesized by solid state reactions at elevated temperature and characterized by powder X-ray diffraction patterns. Magnetic susceptibility measurements of these phases in the temperature range 300 to 800K have been made and the results are reported. (9 refs.)

67900 Low-temperature magnetism of some alkali metal uranates(V) and alkaline earth neptunates(IV). Examples for ferrimagnetism in mixed actinide oxides. E.Konig, C.Rudowicz, V.P.Desai (Inst. fur Phys. und Theoretische Chem., Univ. Erlangen-Nurnberg, Erlangen, Germany), B.Kanellakopulos.
J. Chem. Phys. (USA), vol.78, no.9, p.5764-71 (1 May 1983).
The conventional molecular field (MF) approach is extended to apply to ferrimagnetically coupled f electron systems. The observed curvature of the inverse molar magnetic susceptibility $1/\chi_m$ as a function of temperature is attributed to the sizable effect of the TIP contribution. It is demonstrated that the magnetic behavior of $LiUO_3$, $NaUO_3$, KUO_3, Li_3UO_4, $BaNpO_3$, and $SrNpO_3$ is consistent with that of a two-sublattice ferrimagnet. The calculated $1/\chi_m$ data depend on the Curie constants C_A, C_B, the TIP contributions τ_A, τ_B, and the intrasublattice MF constants α, β. Excellent numerical fits of the experimental magnetic data are obtained above the transition temperature T_c, whereas below T_c the intersublattice MF constant γ has to be increased slightly. Due to the number of parameters involved (C_A, C_B, τ_A, τ_B, α, β), the emphasis is concentrated on the qualitative rather than the quantitative agreement with the applied model. (21 refs.)

67901 Magnetic susceptibility calculations from crystal field theory for high spin ferric complexes of tetragonal character. A.Labarta, X.Vinas, J.Tejada (Facultdad de Fisica, Univ. de Barcelona, Barcelona, Spain).
J. Chem. Phys. (USA), vol.78, no.9, p.5816-19 (1 May 1983).
An analytical expression for the magnetic susceptibility of ferric-high spin complexes with high tetragonal character has been obtained. The authors' analytical expression agrees closely with published data. (5 refs.)

67902 Magnetic properties of $Ni_{0.8}Cu_{0.2-x}Zn_x$ alloys. E.Burzo (Nat. Center of Phys., Bucharest, Rumania), I.Lupsa.
J. Phys. F (GB), vol.13, no.5, p.L89-93 (May 1983).
The authors report the results of magnetic measurements performed on $Ni_{0.8}Cu_{0.2-x}Zn_x$ alloys with $x\leq 20$ at.% Zn, in the temperature range 4.2-1100K and fields up to 50 kG. The saturation magnetisation as well as the Curie temperatures decrease linearly as functions of the valence electron concentration of the CuZn components of the alloys. In the paramagnetic range the susceptibility obeys a modified Curie-Weiss law $\chi=\chi_0+C(T-\theta)^{-1}$. Near the Curie points the low-field magnetisations and initial susceptibilities follow the asymptotic power laws: $M_x\propto t^{\beta}$ and $\chi\propto t^{-\gamma}$ with $\beta=0.35\pm 0.01$ and

γ=1.42+0.04. Finally, they analyse the magnetic behaviour of nickel in the alloys studied. (21 refs.)

67903 Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, X=O, S, Se. J.M.Costantini, D.Damien, C.H.de Novion (DEN, Fontenay-aux-Roses, France), A.Blaise, A.Cousson, H.Abazli, M.Pages.
J. Solid State Chem. (USA), vol.47, no.2, p.210-18 (April 1983).
A study was made of the influence of the chalcogen X on the magnetic and electrical properties of Pu_2O_2X (X=O, S, Se) compounds and on bonding in these hexagonal compounds, isostructural with the corresponding rare-earth compounds. The comparison of the cell volumes of Nd_2O_2X and Pu_2O_2X compounds showed that the Pu^{3+} crystal radius decreased from β-Pu_2O_3 to Pu_2O_2Se as '5*f* delocalization' and 5*f*-*p* overlap increased. These plutonium compounds were all found to be antiferromagnetic. This was caused by superexchange coupling interactions via *p* orbitals of the oxygen and chalcogen ions. The Neel temperature increased from β-Pu_2O_3(26K) to Pu_2O_2S(28K) then to Pu_2O_2Se (34K) showing that 5*f*-*p* covalency was enhanced as the chalcogen electronegativity decreased and the *p* radial extent increased. The hexagonal β-Pu_2O_3 was found to be an insulator while both other compounds were semiconductors with gaps around 0.5 eV. These gaps were interpreted as the energy separation between the 6*d*-7*s* conduction band and the *np* band of the chalcogen X with some overlap of the occupied 5*f* states and the *np* band. A simple electron band scheme of these compounds is proposed on such assumptions. (25 refs.)

67904 Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te. J.M.Costantini, D.Damien, C.H.de Novion (CEN, Fontenay-aux-Roses, France), A.Blaise, A.Cousson, H.Abazli, M.Pages.
J. Solid State Chem. (USA), vol.47, no.2, p.219-24 (April 1983).
Describes the preparation and some physical properties of Pu_2O_2Te. Plutonium oxide telluride is isostructural with the corresponding rare-earth oxide tellurides which crystallize in the tetragonal system of La_2O_2Te-type. Magnetic susceptibility data from 4K to room temperature are reported together with resistivity measurements. Pu_2O_2Te is found to be an antiferromagnet below 56K and a semiconductor with an intrinsic energy gap of 0.65 eV. The magnetic behavior is interpreted in terms of superexchange coupling interactions via nonmetal *p* orbitals, i.e. in terms of 5*f*-*p* overlaps. This conclusion is supported by crystal chemistry considerations by comparison of the cell volumes of Pu_2O_2Te and Nd_2O_2Te. In Pu_2O_2Te, the Pu crystal radius is found to be much lower than that of Nd in Nd_2O_2Te, suggesting some 5*f* electron 'delocalization' leading to a crystal radius shrinkage. As for the hexagonal Pu_2O_2X compounds, with X=O, S, Se, the measured gap may be considered as the energy separation between the chalcogen *np* band and the 6*d*-7*s* conduction band, the occupied 5*f* states lying just below the *np* band with some 5*f*-*np* overlap. (16 refs.)

67905 Transient magnetic susceptibility of ferromagnetic semiconductors. S.S.Rozhkov, A.Yu.Semchuk (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1730-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3056-60 (Oct. 1982). [received: April 1983]
The transient behaviour of nonequilibrium electrons and magnons in ferromagnetic semiconductors is studied. The magnetic susceptibilities during the action of an electric field pulse and after its termination are evaluated. It is shown that the time dependence of the susceptibility is governed by the time dependence of the magnon temperature. (10 refs.)

67906 Magnetic properties of the $Rb_xCs_{1-x}Ni_xMn_{1-x}F_3$ system. F.S.Karapetyan, V.E.Adamyan, P.P.Syrnikov, G.D.Davtyan (Kh. Abovyan State Pedagogical Inst., Erevan, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1791-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3158-61 (Oct. 1982). [received: April 1983]
The authors study the magnetic properties of a series of solid solutions $Rb_xCs_{1-x}Ni_xMn_{1-x}F_3$, where x=0, 0.1, 0.2,..., 1.0. The different magnetic behavior of the isostructural crystals below the temperature of the transition to the ordered state is a good illustration of the rules of Goodenough (1969) and Kanamori (1959), which enable one to predict the magnetic behavior of a crystal in the ordered region on the basis of its structure and chemical composition. The magnetic susceptibility of finely pulverized samples has been studied by the Faraday method on a magnetic balance in the temperature range 4.2-700K and in fields from 3 to 13 kOe. By analyzing the experimental $1/\chi(T)$ curves, they have determined the values of the constants Θ_a, Θ, Θ_b, and C, and from these they calculated the molecular field constants α, β, and n and the exchange integrals I_{AA}, I_{BB}, and I_{AB} characterizing the intra- and intersublattice exchange interactions. (10 refs.)

67907 Existence of an intermediate state in $CuCl_2.2D_2O$ in the AC plane. A.V.Oleinik, P.I.Polyakov (Physicotech. Inst., Acad. of Sci, Donetsk, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1812-13 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3190-2 (Oct. 1982). [received: April 1983]
The results of experimental investigations of antiferromagnetic resonance (AFMR) in specimens of $CuCl_2.2H_2O$ and $CuCl_2.2D_2O$ show that reorientation of the magnetic moment of the lattice in the AC plane takes place through an intermediate state. (5 refs.)

Magnetochemical study of barium titanate doped with tantalum pentoxide .... See Entry 67592

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ ...... See Entry 67850

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction ...... See Entry 67877

Magnetic structure and magnetic properties of non-stoichiometric $Fe_{1-x}O$ ...... See Entry 67894

Isomorphic MeX_2O_4 compounds: anisotropic thermal expansion and magnetic order in $MnSb_2O_4$ ...... See Entry 67895

The magnitude of the rare earth-rare earth exchange interaction in iron garnets ...... See Entry 67915

Volume dependence of the Curie temperature and localised moment in dilute PdFe, PdCo and PdNi alloys ...... See Entry 67920

Phase diagram of the antiferromagnet $CsMnCl_3.2H_2O$ near the bicritical point. Effect of impurities ...... See Entry 67923

Frequency and field dependence of the magnetic susceptibility of an insulating spin glass ...... See Entry 67935

Magnetization of Fe-Cr-Ti spinels ...... See Entry 67967

Magnetic characteristics of La_5Ge_3, Ce_5Ge_3, Pr_5Ge_3 ...... See Entry 67968

Study of the ion distribution and magnetic properties of Y-Ca-In-Ge iron garnet ...... See Entry 68099

Magnetism and crystalline electric fields in $R_2Fe_3Si_5$ compounds ...... See Entry 68102

75.30D Spin waves

(see also 76.50 Spin wave resonance)

67908 Spin-wave damping in ferromagnetic Heisenberg chains: $s={}^1/_2$ and 1. U.Glaus, S.W.Lovesey, E.Stoll (IBM Zurich Res. Lab., Ruschlikon, Switzerland).
Phys. Rev. B (USA), vol.27, no.7, p.4369-74 (1 April 1983).
Numerical calculations of the transverse response function for short-length quantum-spin chains are used to study spin-wave damping at temperatures small compared with the Heisenberg exchange coupling. Results are presented for ferromagnetically coupled systems at several temperatures, for both spin ${}^1/_2$ and 1. At low temperatures, the numerical results are shown to be in good quantitative agreement with the predictions of nonlinear spin-wave theory. (13 refs.)

67909 On the spin wave spectrum in disordered ferromagnets. I.Ya.Korenblit, S.V.Maleyev, E.F.Shender (Leningrad Nuclear Phys. Inst., Gatchina, Leningrad, USSR).
Solid State Commun. (USA), vol.46, no.2, p.117-19 (April 1983).
The spin wave scattering on the low-energy localized magnetic excitations caused by spatial fluctuations of the exchange interaction energy is considered. These excitations resemble in many respects two-level systems in glasses, but their density of states may be much larger. The scattering results in the spin-wave damping, proportional at $\omega \gg T$ to their frequency. The correction to the stiffness coefficient at $T \gg \omega$ increases with the temperature as ln T. (10 refs.)

67910 Spin waves in Fe-Al-Si system. L.Dobrzynski, K.Blinowski, S.Bednarski (Inst. of Nuclear Res., Otwock-Swierk, Poland), H.Kepa, T.Giebultowicz, W.Minor.
Solid State Commun. (USA), vol.46, no.3, p.217-19 (April 1983).
Results of the neutron measurements of magnon dispersion relation in $Fe_{2.937}Al_{0.381}Si_{0.682}$ (Sendust) alloy are presented. The iron-iron interaction in the Fe-Al-Si system is considered and it is shown that the values of nearest-neighbour exchange integrals in the ordered alloys are linearly dependent on the interatomic distance, the rate of the decrease being about 40 meV/Å. This strongly supports a model of competing ferro- and antiferromagnetic interactions usually assumed for concentrated Fe-Al alloys exhibiting spin-glass behaviour. (20 refs.)

67911 Spin-wave excitations in antiferromagnets with an impurity exchange bond. G.N.Karadzhyan (Inst. of Phys. Res., Acad. of Sci., Ashtarak, Armenian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1567-9 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2767-72 (Sept. 1982). [received: April 1983]
A quasiclassical approximation is used to study spin-wave excitations above the Neel ground state in two-sublattice collinear antiferromagnets with an impurity exchange bond J' of an arbitrary sign. It is shown that only one impurity oscillation mode can exist irrespective of the lattice symmetry and it is described in terms of spin waves in an ideal antiferromagnet. Spin-wave exitations occur only for $J'/J>(J'/J)_{cr}$ ($J>0$ is the exchange integral for the crystal matrix). For a BCC lattice this critical parameter assumes the value $(J'/J)_{cr}=-3$. Local energy levels appear near the edges of the spin-wave band of an unperturbed crystal for $J'/J>1$ and their magnitude increases with increasing J'/J. The dynamics of spin deviations is investigated for atoms adjoining an impurity bond and for their nearest neighbors. (8 refs.)

67912 Local levels in the gap of the spin wave spectrum of a ferromagnet containing impurities. A.I.Lukanin, M.V.Medvedev (Inst. of Metal Phys., Acad. of Sci., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1745-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3085-9 (Oct. 1982). [received: April 1983]
Local levels which arise in a ferromagnet with an easy-axis single-ion anisotropy when one of the matrix atoms is replaced by an impurity with an easy-plane single-ion anisotropy are investigated. The effect of the lowest excited states in the gap of the spectrum of quasicontinuous spin excitations on the susceptibility and specific heat of the system is studied (several spin deviations at an impurity are considered). (8 refs.)

Transient magnetic susceptibility of ferromagnetic semiconductors ...... See Entry 67905

On the conditions for a unidirectional D vector in a Dzyaloshinsky-Moriya magnetic chain ...... See Entry 67913

Evidence for scattering of phonons from magnetic excitations in amorphous spin glasses ...... See Entry 67936

Dynamic theory of ferromagnetic-to-spin-glass transition ...... See Entry 67940

Effects of biquadratic exchange interaction on dynamic susceptibility in Heisenberg ferromagnet ...... See Entry 67948

Domain walls and the Holstein-Primakoff transformations ...... See Entry 67956

Amorphons in thin films ...... See Entry 67980

Scattering of volume magnetostatic spin waves by a surface acoustic wave ...... See Entry 67988

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment ...... See Entry 68033

Pressure and temperature dependence of the hyperfine fields of YFe_2, YFe_3 and YIG ...... See Entry 68074

Ferroelectromagnets ...... See Entry 68133

The impurity-induced luminescence of $RbMnF_3$ ...... See Entry 68297

75.30E Exchange and superexchange interactions

(see also 71.70 Level splitting and interactions)

67913 On the conditions for a unidirectional D vector in a Dzyaloshinsky-Moriya magnetic chain. C.E.Zaspel (Dept. of Phys. & Astron., Univ. of Southern Mississippi, Hattiesburg, MS, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5842-3 (1 May 1983).
A Dzyaloshinsky-Moriya exchange interaction with the form $H_{DM}=\Sigma_{ij} D_{ij}.S_i \times S_j$ has been shown to have two interesting effects on a ferromagnet: Melcher (1973) has shown that the spin wave dispersion relation will have a linear term and Liu (1973) in a study of the critical properties of a magnet with antisymmetric exchange has shown that there is a region in the phase diagram corresponding to helical ordering. Both of these results assume that

the D vector is a constant throughout the crystal. The author looks at the D vector on an atomic scale and determines what physical systems will result in a constant D. (5 refs.)

67914 Virtual bound state model for the exchange interaction in semimagnetic semiconductors such as $Cd_{1-x}Mn_xTe$. A.K.Bhattacharjee (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France), G.Fishman, B.Coqblin.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.449-51 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The difference in both sign (i.e. ferromagnetic interaction in the conduction band and antiferromagnetic one in the valence band) and magnitude of the exchange interaction constant in semiconductors such as CdMnTe is explained by a virtual bound state model involving the resonance of the Mn d-level in the valence band. (14 refs.)

67915 The magnitude of the rare earth-rare earth exchange interaction in iron garnets. R.Z.Levitin, V.V.Snegirev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1613-15 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2846-9 (Sept. 1982). [received: April 1983]
It has previously been concluded that in iron garnets the rare earth-rare earth exchange interaction is large and comparable in magnitude to the rare earth-ion exchange interaction. The authors have calculated the theoretical dependences of the susceptibilities of the iron garnets of terbium, dysprosium, holmium, and erbium. The values of the molecular field coefficient λ were found from the values of the molecular field at room temperature. In the calculations the authors used the total quantum number J of the free trivalent ion and the g-factor so as to obtain the best agreement with the experimental data. (9 refs.)

Influence of exchange interaction on band structure of $Pb_{1-x}Mn_xTe$ .... See Entry 67445

The exchange contribution to the binding energy of acceptors in CdMnTe .... See Entry 67527

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction .... See Entry 67877

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, X=O, S, Se .... See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te .... See Entry 67904

Magnetic properties of the $Rb_xCs_{1-x}Ni_xMn_{1-x}F_3$ system .... See Entry 67906

Spin waves in Fe-Al-Si system .... See Entry 67910

Spin-wave excitations in antiferromagnets with an impurity exchange bond .... See Entry 67911

The influence of strong electromagnetic field on Curie temperature of ferromagnetics .... See Entry 67925

Spin dependent effects in semimagnetic semiconductors .... See Entry 67938

Effects of biquadratic exchange interaction on dynamic susceptibility in Heisenberg ferromagnet .... See Entry 67948

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment .... See Entry 68033

NMR of ^{141}Pr in ferromagnetic $GdAl_2$ and $NdAl_2$ .... See Entry 68073

75.30G Anisotropy

67916 Ferromagnets with random anisotropy: longitudinal spin resonance and movable anisotropy. W.M.Saslow (Dept. of Phys., Texas A&M Univ., College Station, TX, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1320-3 (25 April 1983).
Random anisotropy in ferromagnets causes small reorientations of the spins, so that they are not precisely collinear. As a consequence, an anisotropy torque develops for rotations about any axis. This requires the introduction of both a new macroscopic spin variable (to represent the macroscopic orientation about the magnetization) and an anisotropy triad. The macroscopic dynamics, including the dissipative motion of the anisotropy triad, is obtained, and a number of applications are considered. Most striking is the prediction of a longitudinal spin resonance mode. (11 refs.)

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces .... See Entry 64579

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction .... See Entry 67877

How to change or remove the anisotropy of spin glasses, with some other reflections on the anisotropy problem .... See Entry 67934

Investigation of magnetic properties and Mossbauer spectra of $La_xBa_{(1-x)}Fe_{(12-x)}Zn_xO_{19}$ ferrites .... See Entry 67958

Electromagnetic losses in nontextured electrical-engineering steels at high induction and frequency and the influence of domain-structure destabilization .... See Entry 67960

Magnetization of ultra-thin epitaxial Fe films .... See Entry 67977

Magnetic and magneto-optical properties of bismuth-substituted gadolinium iron garnet films .... See Entry 67981

Approximate ferromagnetic resonance relations for (111) garnet films .... See Entry 68031

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment .... See Entry 68033

75.30H Magnetic impurity interactions

67917 Integrability of a one-dimensional Fermi system with magnetic impurities. E.H.Rezayi (Center for Pure & Appl. Phys. Sci., Univ. of California, San Diego, La Jolla, CA, USA), J.Sak.
J. Phys. A (GB), vol.16, no.7, p.L249-54 (11 May 1983).
A one-dimensional metal containing interacting electrons moving in both directions and magnetic impurities is studied. The model is shown to be integrable by the Bethe ansatz provided that an algebraic relation is satisfied between the coupling constants of the electron-electron and electron-impurity interactions. (12 refs.)

Spin-wave excitations in antiferromagnets with an impurity exchange bond .... See Entry 67911

Local levels in the gap of the spin wave spectrum of a ferromagnet containing impurities .... See Entry 67912

Phase diagram of the antiferromagnet $CsMnCl_3.2H_2O$ near the bicritical point. Effect of impurities .... See Entry 67923

75.30K Magnetic phase boundaries

(inc. magnetic transitions, metamagnetism, etc)

67918 Magnetic properties of the ordered VPt_3 alloy. II. Critical behaviour around the Curie point. R.Jesser, A.Bieber, R.Kuentzler (Lab. de Magnetisme et de Structure Electronique des Solides, Inst. de Phys., Strasbourg, France).
J. Phys. (France), vol.44, no.5, p.631-46 (May 1983).
For pt.I see ibid., vol.42, p.1157 (1981). The ferromagnetic properties of the ordered VPt_3 alloy have been systematically investigated in a previous paper (Paper I). These investigations were carried out on bulk VPt_3 samples, one ordered in the Cu_3Au structure (the $VPt_3(1)$ sample) and the other ordered in the $TiAl_3$ structure (the $VPt_3(2)$ sample); disordered (Cu like) VPt_3 is only paramagnetic. In the present paper, the authors report a detailed investigation on the critical properties of $VPt_3(1)$ and (2) around their respective Curie points (240K and 210K). The corresponding magnetization measurements were performed in the moderate field range 0.5 $kOe \leq H \leq 20$ kOe, at several temperatures ranging from 195K to 271K for $VPt_3(1)$ and from 188K to 235K for $VPt_3(2)$. The iterative method used for the determination of T_c, β, γ and δ is described in detail. They found T_c=240.0K, β=0.50, γ=1.19 and δ=3.38 for $VPt_3(1)$, against T_c=210.3K, β=0.51, γ=1.21 and δ=3.38 for $VPt_3(2)$. The critical properties of both VPt_3 samples are well described in the frame of the static scaling theory: Widom's scaling law $\gamma=\beta(\delta-1)$ is well satisfied and the critical DHW (Domb, Hunter, Widom) equation of state holds for $VPt_3(1)$ and (2). (43 refs.)

67919 Cascade first-order phase transitions in quasi-one-dimensional antiferromagnets. Low-temperature analysis. G.V.Uimin (L.D. Landau Inst. of Theoretical Phys., Acad. of Sci., Moscow, USSR).
JETP Lett. (USA), vol.36, no.6, p.250-3 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.201-4 (20 Sept. 1982). [received: April 1983]
It is shown that a cascade of magnetic phase transitions from the antiferromagnetic phase to a phase with magnetization corresponding to one-third the saturation magnetization should exist in some quasi-one-dimensional antiferromagnets. (6 refs.)

67920 Volume dependence of the Curie temperature and localised moment in dilute PdFe, PdCo and PdNi alloys. J.Inoue, M.Shimizu (Dept. of Appl. Phys., Nagoya Univ., Nagoya, Japan).
J. Phys. F (GB), vol.13, no.5, p.1081-90 (May 1983).
The volume dependence of the Curie temperature d ln T_c/d ln V at low T_c for dilute PdFe, PdCo and PdNi alloys is studied by taking into account the volume dependence of the localised moment on the impurity in the itinerant electron model. A model of the local spin fluctuation for the impurity moment is used to reduce the Curie temperature. The result for the condition to determine T_C is found to be similar to that obtained in the s-d model. By making use of the Lang-Ehrenreich model, it is shown that there are two contributions to d ln T_c/d ln V in the limit of $T_C \rightarrow 0$. One is the term obtained in the s-d model and the other comes from the volume dependence of the localised moment on the impurity. The localised moments on Fe and Co atoms are stable and have a very small effect on d ln T_C/d ln V. The localised moment on the Ni atom, however, is small and gives a large contribution to d ln T_C/d ln V. It is concluded that the finite value of d ln T_C/d ln V in the limit of $T_C \rightarrow 0$ results from the existence of the localised moments at $T \geq T_C$ and that the large exerimental values of d ln T_C/d ln V in dilute PdNi alloys can be explained in terms of the large volume dependence of the localised moment on Ni atoms. (32 refs.)

67921 Effects of random fields on the phase diagram of $Mn_{0.875}Zn_{0.125}F_2$. Y.Shapira (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA), N.F.Oliveira,Jr..
Phys. Rev. B (USA), vol.27, no.7, p.4336-50 (1 April 1983).
Phase transitions in $Mn_{1-x}Zn_xF_2$ x=0.125, were investigated using thermal-expansion, magnetostriction, and ultrasonic-attenuation measurements. The phase diagram was determined for $4.2K \leq T \leq T_N$ and $0 \leq H \leq 140$ kOe, where T_N=58.4K is the Neel temperature. The magnetic field H was parallel to [001]. The random field H_R induced by H influences the shape of the λ anomaly at the paramagnetic-antiferromagnetic transition, and depresses the transition temperature $T_c^{\parallel}$. Some evidence for an irreversible behaviour near $T_c^{\parallel}$ is found for $H \neq 0$. The paramagnetic—spin-flop boundary $T_c^{\perp}(H)$ exhibits a large 'bulge' towards high T. At 4.2K, the spin-flop field H_{sf} is 78 kOe, which is lower than that predicted by mean-field theory. The discrepancy is explained by considering the effect of the random fields. As T increases from 4.2K, H_{sf} first increases but then decreases as T approaches the bicritical temperature T_b=55K. It is possible that the latter portion of the spin-flop line is actually one of two second-order lines which surround an intermediate phase. The Neel temperature is in reasonable agreement with mean-field theory. (40 refs.)

67922 Magnetic and quadrupolar phase transitions in cubic rare-earth intermetallic compounds. P.Morin, D.Schmitt (Lab. Louis Neel, CNRS, Grenoble, France).
Phys. Rev. B (USA), vol.27, no.7, p.4412-20 (1 April 1983).
A new analytical approach of the problem of magnetic and quadrupolar phase transitions in rare-earth intermetallic compounds is presented, in terms of single-ion susceptibilities and within the Landau theory. The coefficients of the free-energy expansion are simply related to several magnetic, strain, and quadrupolar crystal-field susceptibilities, the expression of which is given for any multilevel system. The analysis of sign and relative magnitude of these susceptibilities leads to the different possible phase diagrams. Several examples are taken among the cubic rare-earth intermetallic compounds. (28 refs.)

67923 Phase diagram of the antiferromagnet $CsMnCl_3.2H_2O$ near the bicritical point. Effect of impurities. E.Velu, R.Megy, J.Seiden (Inst. d'Electronique Fondamentale, Univ. Paris XI, Orsay, France).
Phys. Rev. B (USA), vol.27, no.7, p.4429-44 (1 April 1983).
The phase diagram of the quasi-one-dimensional antiferromagnet $CsMnCl_3.2H_2O$ (CMC) was determined with great accuracy near the bicritical point T_b=4.3541K, H_b=2.0144 T, and near the Neel point T_N=4.880K. The experimental procedure included susceptibility measurements and ^{35}Cl and ^{133}Cs nuclear magnetic resonance. In the neighbourhood of the bicritical point, the two second-order transitions are described by the theoretical laws provided by the extended scaling theory. The anisotropic crossover exponent $\phi=1.225 \pm 0.005$ is intermediate between the theoretical values for the uniaxial symmetry (n=3) and for the orthorhombic symmetry (n=2). The ratio of

the bicritical amplitudes $\omega_\perp/\omega_\parallel$ is 1, in accordance with a theoretical calculation of the crossover temperature to the orthorhombic behaviour in a quasi-one-dimensional system. The authors have done similar measurements in CMC doped with Co (4 at.%) and Cu (0.4, 0.7, and 2.6 at.%) impurities. The experimental reduction of the bicritical field in CMC:Cu agrees with a theoretical calculation for a quasi-one-dimensional system with diamagnetic impurities. They have determined the phase diagram of CMC:0.7 at.% Cu near the bicritical point. A theoretical calculation shows that the random-field behaviour must be observable. In the neighbourhood of the bicritical point, the two second-order transition lines are described each by a different shift exponent. The upper shift exponent is $1.7<\phi_\perp<3.7$ qualitatively in accordance with the theoretical random-field value obtained by 6-d expansions but the lower shift exponent $1.2<\phi_\parallel<1.5$ does not agree with the expected value close to 1. An explanation can be the destruction of the genuine antiferromagnetic-paramagnetic transition in the presence of random fields at the lower critical dimensionality $d=3$. (43 refs.)

67924 Induced ferromagnetism in $ErRh_4B_4$. L.N.Bulaevskii, A.I.Buzdin, D.I.Khomskii, S.V.Panjukov (Phys. P.N. Lebedev Inst., Moscow, USSR).
Solid State Commun. (USA), vol.46, no.2, p.133-7 (April 1983).
To explain the experimental data on the coexistence of superconductivity and magnetic ordering in $ErRh_4B_4$ the authors suppose that the temperature of the transition to the ferromagnetic state in the absence of superconductivity varies over the samples due to the stresses and this transition is 1st order one or very close to it. They explain the origin of ferromagnetic peaks (F), satellites peaks and broad lines near F-peaks in the framework of the theory, which predicts the domain-like magnetic structure in the coexistence state. The higher satellites peaks intensities in scans are calculated assuming the irregularity of domain structures. (16 refs.)

67925 The influence of strong electromagnetic field on Curie temperature of ferromagnetics. G.M.Genkin, V.V.Zil'berberg (Inst. of Appl. Phys., Acad. of Sci., Gorky, USSR).
Solid State Commun. (USA), vol.46, no.5, p.427-8 (May 1983).
The influence of strong electromagnetic wave on the indirect exchange in rare-earth metals is considered theoretically. The effect of this influence on the Curie temperature is discussed. (3 refs.)

67926 Neutron-diffraction study of the structural and magnetic phase transitions in manganese selenide. G.I.Makovetskii, A.I.Galyas (Inst. of Solid-State & Semiconductor Phys., Acad. of Sci., Minsk, Belorussian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1558-60 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR),* vol.24, no.9, p.2753-6 (Sept. 1982). [received: April 1983]
The results of a neutron-diffraction study of MnSe are reported for the temperature range 77-340K. The Neel temperature determined from the temperature dependence of the intensity of the magnetic reflections of the cubic modification (NaCl structure) comes out to be 135±3K. It is shown that at low temperatures there is an incomplete transition from the cubic modification to a hexagonal one (NiAs structure) The temperature of the inverse transition during heating lies in the range 240-275K. The magnetic ordering in the hexagonal modification persists all the way up to the transition temperature. (11 refs.)

67927 New magnetic state in the compound Fe_2P. E.A.Zavadskii, L.I.Medvedeva, V.I.Val'kov (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1625-6 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR),* vol.24, no.9, p.2864-6 (Sept. 1982). [received: April 1983]
The authors consider the new magnetic state observed in Fe_2P at the first order ferromagnetic-paramagnetic transition. They construct the pressure-temperature phase diagram with the use of an induction method. (3 refs.)

Magnetic thermoelectric power of $Fe_{20}Ni_{60}B_{10}Si_{10}$ metallic glass .... See Entry 67568

Films and surfaces of ferromagnetic superconductors .... See Entry 67849

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction .... See Entry 67877

Isomorphic MeX_2O_4 compounds: anisotropic thermal expansion and magnetic order in $MnSb_2O_4$ .... See Entry 67895

Low-temperature magnetism of some alkali metal uranates(V) and alkaline earth neptunates(IV). Examples for ferrimagnetism in mixed actinide oxides .... See Entry 67900

Magnetic properties of $Ni_{0.8}Cu_{0.2-x}Zn_x$ alloys .... See Entry 67902

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, $X=O$, S, Se .... See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te .... See Entry 67904

Frequency and field dependence of the magnetic susceptibility of an insulating spin glass .... See Entry 67935

Investigation of magnetic properties and Mossbauer spectra of $La_xBa_{(1-x)}Fe_{(12-x)}Zn_xO_{19}$ ferrites .... See Entry 67958

Magnetic and magneto-optical properties of bismuth-substituted gadolinium iron garnet films .... See Entry 67981

Effect of a weak magnetic field on the acoustic properties of terbium near magnetic phase transitions .... See Entry 67987

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment .... See Entry 68033

Mossbauer and X-ray study of $FeP_{0.85}Si_{0.15}$ .... See Entry 68101

Magnetism and crystalline electric fields in $R_2Fe_3Si_5$ compounds .... See Entry 68102

Magnetooptical study of semimagnetic alloys $Cd_{1-x}Mn_xTe$ ..... See Entry 68182

Synthesis and physical properties of $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$ ... See Entry 68434

75.40 CRITICAL-POINT EFFECTS, SPECIFIC HEATS, SHORT-RANGE ORDER

(inc. spin glasses)

67928 On a classical spin glass model. J.L.van Hemmen, A.C.D.van Enter, J.Canisius (Univ. Heidelberg, Heidelberg, Germany).
Z. Phys. B (Germany), vol.50, no.4, p.311-36 (1983).
A simple, exactly soluble, model of a spin-glass with weakly correlated disorder is presented. It includes both randomness and frustration, but its solution can be obtained without replicas. As the temperature T is lowered, the spin-glass phase is reached via an equilibrium phase transition at $T=T_f$. The spin-glass magnetization exhibits a distinct S-shape character, which is indicative of a field-induced transition to a state of higher magnetization above a certain threshold field. For suitable probability distributions of the exchange interactions: (a) A mixed phase is found where spin-glass and ferromagnetism coexist. (b) The zero-field susceptibility has a flat plateau for $0\leq T\leq T_f$ and a Curie-Weiss behaviour for $T>T_f$. (c) At low temperatures the magnetic specific heat is linearly dependent on the temperature. The physical origin of the dependence upon the probability distributions is explained, and a careful analysis of the ground state structure is given. (59 refs.)

67929 Ginzburg-Landau expansion for copper pairs with nonzero angular momentum and analogy between spin glasses and Cooper pair system. A.S.Sigov, V.R.Chechetkin.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.433-6 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
It is shown that the parts of the Ginzburg-Landau expansion corresponding to space-dependent angular and phase transformations have the same structure for all isotropic states with the total angular momentum $J=0$, 1, 2. The analogy between a system of Cooper pairs with nonzero angular momentum and the Sherrington-Kirkpatrick model of a spin glass is discussed. (11 refs.)

67930 Tricritical behaviour in a bond-dilute spin model. H.Dickinson, J.Yeomans (Dept. of Phys., Univ. of Southampton, Southampton, England).
J. Phys. C (GB), vol.16, no.12, p.L345-51 (30 April 1983).
The authors use a Migdal-Kadanoff renormalisation group to study the behaviour of the Blume-Emery-Griffiths model when quenched, random-bond dilution is introduced. Phase diagrams are calculated for varying dilution. The behaviour of the multicritical points of the pure system as dilution is introduced is of particular interest. They find that the tricritical temperature tends to zero as the percolation threshold is approached but that the tricritical field remains finite in agreement with experimental results on the dilute metamagnet $Fe_pMg_{(1-p)}Cl_2$. (16 refs.)

67931 Role of initial conditions in spin glass dynamics and significance of Parisi's $q(x)$. A.Houghton, S.Jain, A.P.Young (Dept. of Math., Imperial Coll., London, England).
J. Phys. C (GB), vol.16, no.12, p.L375-81 (30 April 1983).
The authors argue that standard treatments of dynamics are incorrect for non-ergodic systems such as the Sherrington-Kirkpatrick model of a spin glass. Since the system never loses the memory of its initial state it is necessary to average over initial states with a Boltzmann weight to obtain time-dependent correlation functions as conventionally defined. It is now necessary to introduce replicas. The 'dynamical' order parameter, q_{EA}, is equal to $q(x=1)$ in Parisi's scheme whereas the statistical mechanics order parameter, q, is given by $\int_0^1 q(x)\,dx$. They also propose an interpretation of the function $q(x)$. (18 refs.)

67932 Critical exponents of a system with isotropic multicomponent order parameter. L.M.Khriplovich (Inst. of Inorganic Chem., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.271-3 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR),* vol.36, no.6, p.219-21 (20 Sept. 1982). [received: April 1983]
The critical exponents of the specific heat near the Neel point T_N are determined experimentally for a system with an isotropic four-component order parameter (CO_3O_4). It is shown that the experimental value of α agrees with the value obtained with the renormalization-group method using the ϵ expansion only for $R>T_N$. (5 refs.)

67933 Magnetic satellites in mictomagnetic CuMn. T.M.Harders (Dept. of Phys., Monash Univ., Clayton, Victoria, Australia), P.Wells.
J. Phys. F (GB), vol.13, no.5, p.1017-25 (May 1983).
The neutron scattering intensities about the $1^1/_2 0$ diffuse peak, in 15 and 40 at.% CuMn single crystals have been investigated. It is suggested that the maxima in the diffuse magnetic scattering intensity, which occurs at 1, $1\pm\delta'$, 0 type positions, is caused by an interaction with the conduction electrons. The wavevector of this modulation, indicating a tendency towards spiral magnetic order, is comparable to the Fermi surface diameter. (21 refs.)

67934 How to change or remove the anisotropy of spin glasses, with some other reflections on the anisotropy problem. A.Fert, S.Senoussi, D.Arvanitis (Lab. de Phys. des Solides, Univ. Paris-Sud, Orsay, France).
J. Phys. Lett. (France), vol.44, no.9, p.L345-50 (1 May 1983).
The authors develop some ideas on the freezing of the macroscopic anisotropy energy of spin glasses and introduce the concepts of thermo-remanent anisotropy (TRA) and isothermal remanent anisotropy (IRA). They present results of hysteresis cycle experiments on CuMn alloys which confirm these ideas. In particular they describe a method which allows the authors to reduce the anisotropy at will and even to remove it. (19 refs.)

67935 Frequency and field dependence of the magnetic susceptibility of an insulating spin glass. P.Beauvillain, C.Dupas, J.P.Renard, P.Veillet (Inst. d'Electronique Fondamentale, Univ. Paris Sud, Orsay, France).
J. Magn. & Magn. Mater. (Netherlands), vol.31-34, pt.3, p.1377-8 (Feb. 1983). (Proceedings of the International Conference on Magnetism, Kyoto, Japan, 6-10 Sept. 1982).
The authors have studied the susceptibility of amorphous manganese aluminosilicate for frequencies from 0 to 25 MHz and in DC magnetic fields up to 1000 Oe. The critical behavior of the nonlinear part of the static susceptibility is in qualitative agreement with the mean field theory of the spin-glass transition. (6 refs.)

67936 Evidence for scattering of phonons from magnetic excitations in amorphous spin glasses. D.M.Herlach, E.F.Wassermann, R.Willnecker (Tieftemperaturphys., Univ. Duisburg, Duisburg, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.31-34, pt.3, p.1404-6 (Feb. 1983). (Proceedings of the International Conference on Magnetism, Kyoto, Japan, 6-10 Sept. 1982).
The heat conductivity of amorphous $(Pd_{77.5-x}Cu_6Si_{16.5})Co_x$ spin glass alloys containing $x=0$-15 at.% Co is measured with high accuracy ($\lesssim\pm0.3\%$) in the temperature range $0.3\leq T\leq 25K$ and in magnetic fields $0\leq B\leq 5$ T. For the higher concentrated alloys ('cluster glass' region) the results clearly show the existence of a magnetic contribution in the thermal resistance of phonons. (14 refs.)

67937 Fluctuations in short-range spin-glasses. H.Sompolinsky (Dept. of Phys., Harvard Univ., Cambridge, MA, USA), A.Zippelius.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1297-300 (25 April 1983).
Spatial fluctuations in spin-glasses are studied by an expansion to quadratic order around the dynamic mean-field theory. Below T_c, a spatial decay of the 'spin-glass susceptibility' $[\chi^2(\vec{R},\omega)]_{av}$ is characterized at infinitesimal frequencies by a correlation length $\xi(\omega)$ which diverges as the inverse of the time-dependent Edwards-Anderson order parameter $q(1/\omega)$ in the limit $\omega\rightarrow 0$. The Fourier transform of equal-time correlations $[\langle S(0)S(\vec{R})\rangle]_{av}$ diverges as k^{-4}, signaling a breakdown of mean-field theory at low T below $d=4$. (14 refs.)

67938 **Spin dependent effects in semimagnetic semiconductors.** M.Grynberg (Inst. of Experimental Phys., Univ. of Warsaw, Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.461-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The spin dependent phenomena in semimagnetic semiconductor II-VI compounds with variable concentration of Mn are reviewed. The following topics are emphasized: the exchange interaction between free carriers and magnetic ions, the bound magnetic polaron in CdMnTe and CdMnSe in external magnetic field, the magnetic properties of semimagnetic semiconductors in paramagnetic, 'spin-glass' and antiferromagnetic phase. (36 refs.)

67939 **Critical effects in ferromagnetic semiconductors.** I.Balberg, A.Maman (Racah Inst. of Phys., Hebrew Univ., Jerusalem, Israel), M.Heritier.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.482-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Detailed measurements of the specific heat and the resistivity of $CdCr_2Se_4$ were taken in the vicinity of its critical temperature T_c=130K. The experimental results confirm the predictions for an energy-like critical behaviour of the electronic properties. The results show that the holes in this material are scattered weakly by the spin fluctuations while the electrons propagate in a strongly correlated narrow d-band. (20 refs.)

67940 **Dynamic theory of ferromagnetic-to-spin-glass transition.** M.A.Continentino (Inst. de Fisica, Univ. Federal Fluminense, Rio de Janeiro, Brazil).
Phys. Rev. B (USA), vol.27, no.7, p.4351-8 (1 April 1983).
Studies the interaction between spin waves and magnetic two-level systems (TLS) in a ferromagnet with frustration. The coupling between the magnons and the TLS is due to the modulation of the angle between spins, by the rearrangement of the spins directions when the system tunnels from one metastable state to another. The magnon-TLS interaction causes an instability of the ferromagnetic phase with decreasing temperature due to the appearance of a soft mode. This instability is associated with the disappearance of long-range ferromagnetic order observed in reentrant ferromagnets. (36 refs.)

On the location of the critical point of the *q*-state Potts model on the hypercubic lattice .... See Entry 64842

Exact solution of the Anderson model: I .... See Entry 67416

Exact solution of the Anderson model. II. Thermodynamic properties at finite temperatures .... See Entry 67417

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ ...... See Entry 67850

Field dependences of magnetisation and specific heat coefficient in a nearly magnetic system: Liquid ^{3}He and strong Pauli paramagnets .... See Entry 67879

Short range antiferromagnetic ordering in fluoride glasses 'PbMnFeF$_7$' and 'Pb$_2$MnFeF$_9$' .... See Entry 67897

On the conditions for a unidirectional D vector in a Dzyaloshinsky-Moriya magnetic chain .... See Entry 67913

Cascade first-order phase transitions in quasi-one-dimensional antiferromagnets. Low-temperature analysis .... See Entry 67919

Bound magnetic polarons and spin-flip Raman scattering in (Cd, Mn)Se .... See Entry 68213

75.40D Ising and other classical spin models

67941 **Classical field descriptions of one-dimensional systems.** C.Bourbonnais, L.G.Caron (Dept. de Phys., Univ. de Sherbrooke, Sherbrooke, Quebec, Canada).
Can. J. Phys. (Canada), vol.61, no.4, p.550-63 (April 1983).
The authors discuss the limitations of classical field treatments of one-dimensional systems in the static approximation. Two exactly solvable Hamiltonians, the ferromagnetic Ising model, and its extension to a zero-width half-filled band, are studied after their transformation to a classical field form via the Hubbard-Stratonovich identity. The more usual two-field transformation consists of using one field to describe the divergent order parameter and another to represent the nondivergent modes. The fluctuations in this latter one are usually neglected and this is shown to lead to incorrect thermodynamic behavior throughout the critical region, which is unusually large in one-dimensional systems, and even beyond to the high temperature limit. The findings are extrapolated to other known Hamiltonians: Hubbard, Peierls and spin-Peierls, and Bardeen-Cooper-Schrieffer (BCS) superconductivity. (34 refs.)

67942 **Spontaneous symmetry breaking in spin glasses.** A.P.Young, S.Jain (Dept. of Math., Imperial Coll., London, England).
J. Phys. A (GB), vol.16, no.6, p.L199-204 (21 April 1983).
The authors discuss the effect of a small uniform symmetry breaking field on the Sherrington-Kirkpatrick (1978) spin glass model. Both $q(h)=\langle\langle S_i\rangle_T{}^2\rangle_J$ and $q_{ij}(h)=N\langle\langle S_i\rangle_T\langle S_j\rangle_T-\langle S_iS_j\rangle_T\rangle_J$ are given by scaling functions, $f(h/h^*)$ and $g(h/h^*)$ respectively, where $h^*=T/N^{1/2}$. They show that $g(x)=xf'(x)$ so that in the symmetry broken situation ($h/h^*\rightarrow\infty$ but $h\ll 1$) one has $f(x)\rightarrow q$, the statistical mechanics order parameter, and $g(x)\rightarrow q_{ij}=0$. The latter is in contrast to the conclusions of Young and Kirkpatrick based on numerical evidence for small samples. They discuss the reasons for this discrepancy. (13 refs.)

67943 **Phase separations in Ising model with free boundary condition.** K.Kuroda (Dept. of Math., Keioi Univ., Tokyo, Japan).
J. Stat. Phys. (USA), vol.30, no.1, p.1-13 (Jan. 1983).
Considers the problem of phase separations in Ising model with free boundary condition. The author proves that a typical configuration has just one open contour λ which separates V into two parts which are occupied by the opposite phases. λ is the shortest possible contour compatible with the condition that V is divided by λ into two regions of area $\rho|V|$ and $(1-\rho)|V|$. (8 refs.)

67944 **Comparison of different boundary conditions for Monte Carlo simulations of Ising models.** N.Jan (Center for Polymer Studies, Boston Univ., Boston, MA, USA), M.O.Steinitz.
J. Stat. Phys. (USA), vol.30, no.1, p.37-44 (Jan. 1983).
The effects of various boundary conditions on the Monte Carlo method have been studied through an analysis of the two-dimensional Ising model using a 30×30 system. The following boundary conditions were used: mean field, free edges, periodic, and correlated. The results confirm the reliability of periodic boundary conditions but the correlated boundary conditions are comparable and in some instances yield results (the critical temperature for example) that are in better agreement with the exact values. (7 refs.)

67945 **Residual entropy of the one-dimensional Ising antiferromagnet with general spin.** D.Hajdukovic, S.Milosevic (Dept. of Phys. & Meteorology, Faculty of Natural & Math. Sci., Belgrade, Yugoslavia).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.57-8 (11 April 1983).
The authors have calculated the ground-state degeneracy and the concomitant residual entropy of the one-dimensional Ising antiferromagnet in a critical magnetic field. They demonstrate that the results obtained can be related to the ground-state properties of the *q*-state Potts antiferromagnet in the corresponding external field. (8 refs.)

Nonlinear scaling fields and corrections to scaling near criticality .... See Entry 64872

Random-field induced interface widths in Ising systems .... See Entry 67872

The isothermal and frequency-dependent perpendicular susceptibilities of the one-dimensional alternating Ising model .... See Entry 67875

75.40F Heisenberg and other quantized spin models

67946 **Linked cluster expansion for quantum spins.** K.J.Niskanen (Res. Inst. for Theoretical Phys., Univ. of Helsinki, Helsinki, Finland), J.Kurkijarvi.
J. Phys. A (GB), vol.16, no.7, p.1491-504 (11 May 1983).
A vertex renormalised selfconsistent graph model for a quantum spin system is presented with the ordering transition temperature appreciably lowered from the classical value for a small spin quantum number *I*. The model applies for example to the dipole-dipole interaction in addition to the exchange interactions. The derivation is restricted to zero external field. (20 refs.)

67947 **Monte Carlo study of a Heisenberg antiferromagnet on an FCC lattice with and without dilution.** J.F.Fernandez (Inst. Venezolano de Investigaciones Cientificas, Caracas, Venezuela), H.A.Farach, C.P.Poole,Jr., M.Puma.
Phys. Rev. B (USA), vol.27, no.7, p.4274-80 (1 April 1983).
A Monte Carlo simulation is performed of a Heisenberg model with nearest-neighbour antiferromagnetic interaction. It is carried out on a FCC lattice of size $n\times n\times n$ unit cells, where n=4, 6, and 8 ($4n^3$ spins), with a fraction (x) of the sites occupied by N spins. This model, which is random for $x<1$, on a frustrated lattice, is related to nonconducting spin-glasses, such as $Cd_{1-x}Mn_xTe$. For x=0.5 and 1, the authors calculated the following quantities: (i) the specific heat C; (ii) $q(t)=N^{-1}\Sigma_i\langle\mathbf{S}_i(0).\mathbf{S}_i(t)\rangle$; and (iii) the relaxation time (τ) associated with $q(t)$. For x=1, a singularity in C versus the temperature seems to develop at $T\simeq 0.4J/k_B$, which becomes sharper as N becomes larger, and τ seems to diverge as $T\rightarrow 0.4J/k_B$ also. Furthermore, additional results for systems of $8\times 8\times n$ cells (256n spins) for n=2, 4, and 8, show that the peak in C becomes rounded as n decreases. For x=0.5, C seems to be smooth in T and independent of N, and $\tau\sim T^{-3}$ which indicates that there is no transition for $T\neq 0$. Thus this model seems to lack some essential ingredient to describe the paramagnetic to spin-glass transition seen experimentally in systems such as $Cd_{1-x}Mn_xTe$. (20 refs.)

67948 **Effects of biquadratic exchange interaction on dynamic susceptibility in Heisenberg ferromagnet.** R.N.Shrivastava, M.Tiwari (Inst. of Technol., Banaras Hindu Univ., Varanasi, India).
Solid State Commun. (USA), vol.46, no.2, p.189-92 (April 1983).
The Green function technique has been employed to study the dynamic susceptibility of a spin-1 system above the Curie temperature. Bilinear and biquadratic terms have been added in writing the Hamiltonian of the system. Higher order Green functions have been decoupled by RPA and Callen type decouplings. The dependence of spin wave energy, intensity and susceptibility on wavevector and biquadratic parameter have been studied. (18 refs.)

67949 **Critical exponents for alternation in Heisenberg antiferromagnetic chains.** S.Ramasesha, Z.G.Soos (Dept. of Chem., Princeton Univ., Princeton, NJ, USA).
Solid State Commun. (USA), vol.46, no.7, p.509-11 (May 1983).
The ground-state energy per site, $\lambda(\delta)$, and singlet-triplet gap, $\Delta E(\delta)$, of regular (δ=0) and alternating ($\delta\leq 0.01$) Heisenberg antiferromagnetic chains are obtained by extrapolating exact numerical solutions of even and odd rings and chains of $N\leq 20$ spins. The critical exponents of 1.72±0.02 for $\lambda(\delta)$ and 0.9±0.1 for $\Delta E(\delta)$ are compared with recent theoretical results for spin-Peierls transitions. Interactions among spinless fermions alter the instability to alternation. (18 refs.)

Spin-wave damping in ferromagnetic Heisenberg chains: $s={}^1/_2$ and 1 .... See Entry 67908

75.50 STUDIES OF SPECIFIC MAGNETIC MATERIALS

(see also 81.40R Magnetic properties related to materials treatment)

75.50B Ferromagnetism of Fe and its alloys

Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys .... See Entry 64574

Amorphous to crystalline transformation of $Fe_{81}B_{13.5}Si_{3.5}C_2$ .... See Entry 66853

Study of the structural evolution in metallic glass $Fe_{83}B_{14}Si_{1.5}C_{1.5}$ by measuring internal friction and Young's modulus .... See Entry 66890

Thermal expansion coefficient and Young's modulus of hydrogenated FCC Fe-Ni Invar alloys .... See Entry 67087

Magnetic thermoelectric power of $Fe_{20}Ni_{60}B_{10}Si_{10}$ metallic glass .... See Entry 67568

Spin waves in Fe-Al-Si system .... See Entry 67910

Volume dependence of the Curie temperature and localised moment in dilute PdFe, PdCo and PdNi alloys .... See Entry 67920

Basic properties of grain-oriented electro-technical steels. Vol. II: Flux distribution and waveforms .... See Entry 67950

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Magnetically active coatings and the structure of a metal-ceramic composite. .... See Entry 67954

Influence of additives in the composition of thermostable coatings of the structure and properties of the alloy Fe-3% Si .... See Entry 67955

Electromagnetic losses of thin magnetically soft ferromagnets at prevailed magnetic-reversal frequencies .... See Entry 67959

Electromagnetic losses in nontextured electrical-engineering steels at high induction and frequency and the influence of domain-structure destabilization .... See Entry 67960

Energy losses during rotational magnetic reversal in electrical-engineering steel alloyed aluminum .... See Entry 67961

Influence of cooling rate on the magnetic properties of untextured electrical-engineering steels .... See Entry 67962

New method of reducing the coercive force and electromagnetic losses in (110) [001] crystal of the alloy Fe-3.2% SI .... See Entry 67963

Magnetic properties of Fe-Si alloys at high frequencies .... See Entry 67964

Electron spin polarized tunneling study of ferromagnetic thin films .... See Entry 67972

Magnetic properties of Fe-Ni Invar alloy films .... See Entry 67979

Magnetoelastic effect in the excitation of the steel by elastic oscillations .... See Entry 67989

Surface magnetic properties of amorphous ferromagnets studied using electron spin polarization .... See Entry 67990

Surface studies of amorphous metallic glass by magnetic resonance (Resonance surface studies of $Fe_{40}Ni_{40}B_{20}$) .... See Entry 68034

Pressure and temperature dependence of the hyperfine fields of YFe_2, YFe_3 and YIG .... See Entry 68074

Ellipsometric investigation of thin Permalloy films .... See Entry 68342

Thickness dependence of the polar Kerr effect in thin ferromagnetic films .... See Entry 68353

Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state .... See Entry 68526

Effect of composition on deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust .... See Entry 68570

75.50C Ferromagnetism of other metals

Ferromagnetic pinning of superconducting fluxoids at the contact between Sn and Gd films .... See Entry 67870

Magnetic properties of $Ni_{0.8}Cu_{0.2-x}Zn_x$ alloys .... See Entry 67902

Virtual bound state model for the exchange interaction in semimagnetic semiconductors such as $Cd_{1-x}Mn_xTe$ .... See Entry 67914

Magnetic properties of the ordered VPt_3 alloy. II. Critical behaviour around the Curie point .... See Entry 67918

Volume dependence of the Curie temperature and localised moment in dilute PdFe, PdCo and PdNi alloys .... See Entry 67920

Critical effects in ferromagnetic semiconductors .... See Entry 67939

Magnetic domain studies on single-domain particles of the low-temperature phase of MnBi by the colloid-SEM method .... See Entry 67970

Electron spin polarized tunneling study of ferromagnetic thin films .... See Entry 67972

Magnetic domain structures in CoCr films studied by Lorentz microscopy .... See Entry 67984

Effect of a weak magnetic field on the acoustic properties of terbium near magnetic phase transitions .... See Entry 67987

Spin-wave resonance in single crystal nickel films .... See Entry 68035

NMR of ^{141}Pr in ferromagnetic $GdAl_2$ and $NdAl_2$ .... See Entry 68073

Thickness dependence of the polar Kerr effect in thin ferromagnetic films .... See Entry 68353

Synthesis and physical properties of $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$ .... See Entry 68434

75.50D Ferromagnetism of nonmetals

Films and surfaces of ferromagnetic superconductors .... See Entry 67849

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ .... See Entry 67850

Induced ferromagnetism in $ErRh_4B_4$ .... See Entry 67924

Magnetic characteristics of La_5Ge_3, Ce_5Ge_3, Pr_5Ge_3 .... See Entry 67968

Pressure and temperature dependence of the hyperfine fields of YFe_2, YFe_3 and YIG .... See Entry 68074

75.50E Antiferromagnetics

Magnetic defects in antiferromagnetically ordered $Mn_{1-n}Zn_nF_2$ mixed fluorides .... See Entry 67893

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Isomorphic MeX_2O_4 compounds: anisotropic thermal expansion and magnetic order in $MnSb_2O_4$ .... See Entry 67895

Short range antiferromagnetic ordering in fluoride glasses '$PbMnFeF_7$' and 'Pb_2MnFeF_9' .... See Entry 67897

Quasi-ferromagnetism in antiferromagnetic $GdVO_4$ .... See Entry 67898

Magnetic susceptibility of $La_{1-x}Nd_xTlO_3$ system ($0.0 \leq x \leq 1.0$) [and synthesis and X-ray characterisation] .... See Entry 67899

Crystal chemistry, magnetic, and electrical properties of hexagonal plutonium oxide chalcogenides: Pu_2O_2X, X=O, S, Se .... See Entry 67903

Crystal chemistry, magnetic, and electrical properties of the tetragonal plutonium oxide telluride Pu_2O_2Te .... See Entry 67904

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Existence of an intermediate state in $CuCl_2.2D_2O$ in the AC plane .... See Entry 67907

Spin waves in Fe-Al-Si system .... See Entry 67910

Virtual bound state model for the exchange interaction in semimagnetic semiconductors such as $Cd_{1-x}Mn_xTe$ .... See Entry 67914

Effects of random fields on the phase diagram of $Mn_{0.875}Zn_{0.125}F_2$ .... See Entry 67921

Phase diagram of the antiferromagnet $CsMnCl_3.2H_2O$ near the bicritical point. Effect of impurities .... See Entry 67923

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Critical exponents of a system with isotropic multicomponent order parameter .... See Entry 67932

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Magnetic characteristics of La_5Ge_3, Ce_5Ge_3, Pr_5Ge_3 .... See Entry 67968

Antiferromagnetism of FCC iron films .... See Entry 67978

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Magnetic resonance in $(C_2H_5NH_3)_2CuCl_4$ at low frequencies .... See Entry 68032

Mossbauer and X-ray study of $FeP_{0.85}Si_{0.15}$ .... See Entry 68101

Magnetism and crystalline electric fields in $R_2Fe_3Si_5$ compounds .... See Entry 68102

Magnetooptical study of semimagnetic alloys $Cd_{1-x}Mn_xTe$ .... See Entry 68182

The impurity-induced luminescence of $RbMnF_3$ .... See Entry 68297

75.50G Ferrimagnetics

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Low-temperature magnetism of some alkali metal uranates(V) and alkaline earth neptunates(IV). Examples for ferrimagnetism in mixed actinide oxides .... See Entry 67900

Magnetic properties of the $Rb_xCs_{1-x}Ni_xMn_{1-x}F_3$ system .... See Entry 67906

The magnitude of the rare earth-rare earth exchange interaction in iron garnets .... See Entry 67915

Investigation of magnetic properties and Mossbauer spectra of $La_xBa_{(1-x)}Fe_{(12-x)}Zn_xO_{19}$ ferrites .... See Entry 67958

Enhancement of permeability in ferrite toroids subjected to rotating magnetic fields .... See Entry 67966

Magnetization of Fe-Cr-Ti spinels .... See Entry 67967

Magnetic characteristics of La_5Ge_3, Ce_5Ge_3, Pr_5Ge_3 .... See Entry 67968

Investigation of magnetic after-effect in cobalt-doped thin garnet films .... See Entry 67971

Magnetic and magneto-optical properties of bismuth-substituted gadolinium iron garnet films .... See Entry 67981

Magnetoelastic properties of yttrium iron garnet doped with Tb^{3+} and Yb^{3+} ions .... See Entry 67986

Scattering of volume magnetostatic spin waves by a surface acoustic wave .... See Entry 67988

Approximate ferromagnetic resonance relations for (111) garnet films .... See Entry 68031

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment .... See Entry 68033

Photoinduced change in SWR spectra of Si-deposited YIG thin films .... See Entry 68036

Resonance of domain boundaries in single-crystal magnets .... See Entry 68037

Study of the ion distribution and magnetic properties of Y-Ca-In-Ge iron garnet .... See Entry 68099

The effects of calcining and sintering conditions on the permeability and loss of Mn-Zn-Fe ferrite .... See Entry 68669

75.50K Amorphous magnetic materials

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces .... See Entry 64579

Amorphous to crystalline transformation of $Fe_{81}B_{13.5}Si_{3.5}C_2$ .... See Entry 66853

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75.60 DOMAIN EFFECTS, MAGNETIZATION CURVES, AND HYSTERESIS

67950 Basic properties of grain-oriented electro-technical steels. Vol. II: Flux distribution and waveforms.
Report EUR 6647/II EN, Comm. European Communities, Luxembourg (1982), xlvii+153 pp. Contract 6210.KL/8/801.
A study was made of 3.25% grain oriented electrotechnical steel (electrical steel) produced in accordance with ARMCO teachings. The factors affecting the efficiency of the magnetic mechanisms within the material were revealed and the criteria necessary to be fulfilled to maximise the magnetic properties were specified. The nature of flux distributions and the character of circulating flux—particularly in the joints of magnetic circuits—in the transformer and rotating machine applications were revealed. Also a technique for recording waveforms in a full size transformer core was developed to a practical level with a view to using these recordings to drive laboratory test apparatus with these 'real' waveforms. New information on magnetostriction behaviour under the combined effects of stress with temperature was provided as a basis for further work and to assist designers of machines which run at temperatures above ambient. Additional work has defined the nature of the change in magnetic properties with temperature and with two-dimensional stress. (23 refs.)

Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys .... See Entry 64574

Quasi-ferromagnetism in antiferromagnetic $GdVO_4$ .... See Entry 67898

75.60C Domain walls and domain structure

(for magnetic bubbles, see 75.70K)

67951 Muonic method of investigating the magnetic properties of electrical-engineering steels. S.G.Barsov, A.L.Getalov, V.A.Gordeev, V.N.Goralkin, P.L.Gruzin, S.P.Kruglov, L.A.Kuz'min, V.P.Mel'nichuk, S.M.Mikirtych'yants, V.Yu.Miloserdin, V.P.Smilga, G.V.Shcherbakov (Moscow Engng. Phys. Inst., Moscow, USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.18-20 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.643-5 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

It is shown that a muonic method not only allow the magnetic-texture parameters of nonmagnetized materials to be investigated, but also allows the magnetic properties of materials at different stages of production to be monitored. (1 ref.)

67952 Dynamic domain structure of (111) crystals of Fe-3.2% Si alloy. V.P.Makarov, B.V.Molotilov, V.P.Kuz'mishko, B.A.Kornienkov (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.21-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.646-51 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

The dynamic domain structure of (111) crystals of Fe-3.2% Si alloy with quasistatic and dynamic reversal is investigated by X-ray topographic and powder methods. The domain-structure topography in the volume and at the surface of the crystal is interpreted. (1 ref.)

67953 Influence of a coating on the domain structure of highly textured electrical-engineering steel. S.V.Zhakov, B.N.Filippov (Inst. of Metal Phys., Acad. of Sci., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.29-33 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.655-9 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

In the thin-plate approximation, the influence of the stress created by a coating on the domain size in single crystals with a surface plane of type (110) is calculated. It is shown the coating may decrease the domain size by a factor of 2.5-3. (8 refs.)

67954 Magnetically active coatings and the structure of a metal-ceramic composite.. V.P.Makarov, V.G.Matsuk, B.V.Molotilov.

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.660-5 gr 34-9 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

For the example of the alloy Fe-3.2% Si, the influence of magnetically active coatings on the domain structure and magnetic properties is considered. It is shown that the domain structure depends significantly on the kinetics of the process of coating formation. Possible methods of forming an optimal transition process of coating formation. Possible methods of forming an optimal transition layer are considered. The influence of the initial sample texture on the magnetic properties of the composite is discussed. (5 refs.)

67955 Influence of additives in the composition of thermostable coatings of the structure and properties of the alloy Fe-3% Si. G.A.Brashevan, T.V.Zhitkova, A.K.Belyavskii, S.V.Fedorova (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.87-9 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.716-18 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

The influence of additives in the composition of thermostable coatings (TC) on the structure, the crystallographic and magnetic texture, and also the magnetic properties of anisotropic steel is investigated. It is shown that introducing additives of Ti, B compounds in the TC composition leads to change in grain structure and improvement in magnetic properties, and facilitates the formation of a high-quality coating. (7 refs.)

67956 Domain walls and the Holstein-Primakoff transformations. M.S.Swanson (Dept. of Phys., Univ. of Connecticut, Storrs, CT, USA).

Phys. Rev. B (USA), vol.27, no.7, p.4421-8 (1 April 1983).

The problem of determining the interaction of spin waves in the presence of a domain wall is examined. The Hamiltonian for a ferromagnet with a uniaxial anisotropy is rewritten in terms of harmonic oscillators with the use of the Holstein-Primakoff transformations (1940). In the continuum limit a nonrelativistic scalar field theory is obtained. The equation of motion in three spatial dimensions admits domain-wall solutions. The Hamiltonian is expanded about the classical solution and the quadratic terms are used to generate the spin-wave spectrum. The results are shown to be consistent with other methods. The space of states and propagators are exhibited, and the extension to the higher-order terms governing spin-wave interactions is discussed. (16 refs.)

67957 Deformation-induced domains in antiferromagnets. V.V.Gann, A.I.Zhukov (Physicotech. Inst., Acad. of Sci., Kharkov, Ukrainian SSR).

Sov. Phys.-Solid State (USA), vol.24, no.9, p.1584-5 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2799-802 (Sept. 1982). [received: April 1983]

The structure of the ground state of an antiferromagnet with an 'easy-plane' type magnetic anisotropy subjected to unidirectional strain in an external magnetic field is investigated. It is shown that in a definite strain interval, a nonuniform state consisting of two or more domains separated by domain walls is energetically favorable. A phase diagram of a two-phase system containing a magnetoelastic domain wall in a finite specimen is constructed. (3 refs.)

Electromagnetic losses in nontextured electrical-engineering steels at high induction and frequency and the influence of domain-structure destabilization .. ..See Entry 67960

Magnetic domain studies on single-domain particles of the low-temperature phase of MnBi by the colloid-SEM method ....See Entry 67970

Magnetic domain structures in CoCr films studied by Lorentz microscopy ....See Entry 67984

Resonance of domain boundaries in single-crystal magnets ......See Entry 68037

Amplification effects for nuclei in domain boundaries at low temperatures ....See Entry 68053

75.60E Magnetization curves, hysteresis, Barkhausen and related effects

67958 Investigation of magnetic properties and Mossbauer spectra of $La_xBa_{(1-x)}Fe_{(12-x)}Zn_xO_{19}$ ferrites. Du You-We, Lu Huai-Xian, Zhang Yu-Chang, Hui Li-Ren, Wang Ting-Xiang (Dept. of Phys., Nanjing Univ., Nanjing, China).

Acta Phys. Sin. (China), vol.32, no.2, p.168-75 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*

The hexagonal ferrites $La_xBa_{(1-x)}Fe_{(12-x)}Zn_xO_{19}$ were prepared by oxalate coprecipitation method. The ferrites with magnetoplumbite structure were found to be formed for $x<0.8$, the specific magnetization σ increases with increasing x, but Curie temperature θ_f and the magnetic crystal anisotropy constant k decreases with increasing x. Mossbauer spectra have revealed that Zn^{2+} ion tends to occupy $4f_2$ site. (21 refs.)

67959 Electromagnetic losses of thin magnetically soft ferromagnets at prevailed magnetic-reversal frequencies. Yu.N.Dragoshanskii, A.P.Potapov, A.A.Glazer (Inst. of Metal Phys., Acad. of Sci., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.1-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.626-9 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

The change in electromagnetic losses associated with narrowing of a tape of the electrical-engineering alloy Fe-3% Si with a crystalline texture of type (110) [001] of different degrees of perfection is investigated, in the range of induction $B_m=0.8$-1.6 T and of magnetic-reversal frequency $f=400$-10000 Hz. A significant reduction in losses is shown with decrease in tape thickness from 300 to 30 μ; the rate of this reduction is higher in materials with more perfect texture. (7 refs.)

67960 Electromagnetic losses in nontextured electrical-engineering steels at high induction and frequency and the influence of domain-structure destabilization. N.V.Dmitrieva, I.E.Startseva, V.V.Shulika (Inst. of Metal Phys., Acad. of Sci., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.5-7 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.630-2 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

The role of various magnetization processes in the formation of electromagnetic losses of untextured electrical-engineering steel with 4 ct.% Si is investigated, and degree to which stabilization of the domain structure due to induced anisotropy affects the lossses is elucidated, for various frequencies (from 60 to 10000 Hz) and inductions (up to 1.5 T). (7 refs.)

67961 Energy losses during rotational magnetic reversal in electrical-engineering steel alloyed aluminum. G.S.Korzunin, L.A.Inisheva (Inst. of Metal Phys., Acad. of Sci., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.8-10 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.633-5 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

Results are given of measurements of the losses during rotational magnetic reversal of electrical-engineering steels with different chemical compositions and electrical resistivities at frequencies of 10-70 Hz. At 50 Hz, the losses during rotational magnetic reversal are compared with those during cyclic magnetic reversal. (5 refs.)

67962 Influence of cooling rate on the magnetic properties of untextured electrical-engineering steels. I.E.Startseva, V.V.Shulika, V.A.Lukshina.

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.11-13 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.636-8 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

It is shown that, by increasing the rate of cooling after heat treatment in the temperature range 400-800°C, the basis magnetic characteristics of untextured electrical-engineering steels with a small carbon content may be significantly improved. (4 refs.)

67963 New method of reducing the coercive force and electromagnetic losses in (110) [001] crystal of the alloy Fe-3.2% SI. V.P.Makarov, B.A.Kornienkov, B.V.Molotilov, V.P.Kuz'mishko (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.14-17 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.639-42 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

A new method is proposed for reducing the coercive force and electromagnetic losses in (110) [001] crystals of the alloy Fe-3.2% Si by forming a developed block structure in them. Possible mechanisms leading to reduction in H_c and the losses are proposed. (8 refs.)

67964 Magnetic properties of Fe-Si alloys at high frequencies. L.V.Mironov, Z.N.Bulycheva, B.B.Mints, L.K.Kurennykh, A.A.Petrovskii, V.A.Alekseev (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.26-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.652-4 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

The magnetic properties of Fe-Si alloys containing 3 and 4.5% Si are investigated in the frequency range 400-20000 Hz. Magnetization curves at 400, 1000, and 2000 Hz are given. The dependence of the total magnetic energy losses on the frequency of the magnetizing field and the amplitude of the magnetic induction is obtained. The influence of the sample structure is shown. (3 refs.)

67965 Investigating the regular behavior of the magnetic losses of cold-rolled isotropic electrical-engineering steel with the aim of creating standard samples. A.S.Veksler, N.N.Yagovkina (D.I. Mendeleev All Union Sci. Res. Inst. of Metrology, USSR).

Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.40-2 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.666-8 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).

Dependence of the specific magnetic losses of samples of cold-rolled isotropic electrical-engineering steel on the amplitude of the magnetic induction, the degree of distortion of the induction flux, the magnitude of the magnetic flux outside the sample, and the temperature are obtained. (4 refs.)

67966 Enhancement of permeability in ferrite toroids subjected to rotating magnetic fields. G.Zini, F.Ronconi, F.Masoli, G.Buttino (Istituto di Fisica, Univ. of Ferrara, Ferrara, Italy).
J. Appl. Phys. (USA), vol.54, no.4, p.2121-2 (April 1983).
This paper reports the effects of test field parameters on the measurements of complex permeability in flat ferrite toroids, carried out by the AC bridge method during the rotation of a DC magnetic field, applied in the toroid plane. Under such conditions the permeability is generally higher than when measured with the DC field in a fixed direction and it can be controlled by proper choice of the test and rotating magnetic fields. The enhancement has been interpreted as due mostly to a direct influence of the test field upon the irreversible wall displacements produced by the rotating field. (5 refs.)

67967 Magnetization of Fe-Cr-Ti spinels. E.Schmidbauer (Inst. fur Allgemeine und Angewandte Geophys., Univ. Munchen, Munchen, Germany).
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.124-6 (1983).
Magnetic properties are reported for the spinel series $Fe_{2.4-t}Cr_{0.6}Ti_tO_4$, $O \leq t \leq 0.7$, with $t=0$, 0.2, 0.4, 0.6 and $Fe_{2.1-t}Cr_{0.9}Ti_tO_4$, $0 \leq t \leq 0.55$, with $t=0$, 0.2, 0.4, 0.45, 0.5. Magnetic moment data are compared with theoretical values derived from different ion distribution models. With increasing Ti concentration the compositions become hard magnetic spinels due to the increased number of Fe^{2+} ions on A- and B-sites of the spinel lattice. (11 refs.)

67968 Magnetic characteristics of La_5Ge_3, Ce_5Ge_3, Pr_5Ge_3. R.P.Krentsis, S.M.Barmin, A.A.Sevast'yanov, P.V.Gel'd (S.M. Kirov Ural Polytech. Inst., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1620-1 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2856-9 (Sept. 1982). [received: April 1983]
The authors have investigated the dependence on field and temperature of the magnetization (σ) of La_5Ge_3, Ce_5Ge_3 and Pr_5Ge_3 between 4.2 and 300K and also the temperature dependence of the magnetic susceptibility (χ) in the range from 80 to 600K. (7 refs.)

The exchange contribution to the binding energy of acceptors in CdMnTe .... See Entry 67527

Hopping conduction of the bound magnetic polarons in n-CdMnSe .... See Entry 67606

Superconducting and magnetic properties of $Y_{0.9}R_{0.1}Rh_4B_4$ ...... See Entry 67850

Electron structure and magnetic state of rare-earth compounds with a weak exchange interaction .... See Entry 67877

Magnetic structure and magnetic properties of non-stoichiometric $Fe_{1-x}O$ .... See Entry 67894

Magnetic properties of $Ni_{0.8}Cu_{0.2-x}Zn_x$ alloys .... See Entry 67902

Magnetic properties of the ordered VPt_3 alloy. II. Critical behaviour around the Curie point .... See Entry 67918

Dynamic domain structure of (111) crystals of Fe-3.2% Si alloy .... See Entry 67952

Magnetic properties of Fe-Ni Invar alloy films .... See Entry 67979

Magnetic domain structures in CoCr films studied by Lorentz microscopy .... See Entry 67984

Resonance of domain boundaries in single-crystal magnets ...... See Entry 68037

Magnetooptical study of semimagnetic alloys $Cd_{1-x}Mn_xTe$ ..... See Entry 68182

Synthesis and physical properties of $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$ ... See Entry 68434

Preparation of a Ni-Zn ferrite from a submicronic grain size powder .... See Entry 68484

Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state .... See Entry 68526

Effect of composition on deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust .... See Entry 68570

The effects of calcining and sintering conditions on the permeability and loss of Mn-Zn-Fe ferrite .... See Entry 68669

75.60J Fine-particle systems

67969 Size effect of magnetic moment density of dispersed nickel. T.S.Cale, J.T.Richardson, J.Ginestra (Dept. of Chem. Engng, Univ. of Houston, Houston, TX, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.744-6 (15 April 1983).
An extension of superparamagnetic superposition analysis is used to show a crystallite size effect on the magnetic moment density of nickel dispersed on silica. A clear effect on room-temperature moment density is seen for samples with crystallites much less than 3 nm in radius. (9 refs.)

67970 Magnetic domain studies on single-domain particles of the low-temperature phase of MnBi by the colloid-SEM method. M.Munakata, K.Goto, T.Sakurai (Res. Inst. for Sci. Measurements, Tohoku Univ., Sendai, Japan).
Philos. Mag. B (GB), vol.47, no.4, p.431-6 (April 1983).
Magnetic domains of isolated small particles of the low-temperature phase of MnBi in the ball-milled state after sintering have been studied by the colloid-SEM (scanning electron microscope) method, a modified Bitter method, with magnifications from 10000× to 45000×. By decreasing the particle size, domain patterns characteristic of the single-domain particles were found. Observations show that the critical size of the single-domain particle is greater than 1 μm which is larger than the theoretical value of about 0.5 μm. This difference is discussed. (28 refs.)

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces .... See Entry 64579

The effect of magnetostatic interaction on the magnetization of the ensemble of ferromagnetic mineral single domain particles .... See Entry 69200

75.60L Magnetic aftereffects

67971 Investigation of magnetic after-effect in cobalt-doped thin garnet films. S.Uba, A.Maziewski (Warsaw Univ., Bialystok, Poland), J.Simsova.
J. Phys. C (GB), vol.16, no.12, p.L383-6 (30 April 1983).
Unexpectedly small velocities of demagnetisation processes have been observed in $Y_2Ca_1Fe_{39}Co_{0.1}Ge_1O_{12}$ films. These phenomena have been investigated in the experimental set-up based on the Faraday effect. The investigated after-effects have been numerically analysed in terms of continuous distribution of relaxation times τ. Strong dependences of τ on temperature and applied magnetic field have been found. The activation character of relaxation processes has been determined. (5 refs.)

75.70 MAGNETIC FILMS AND PLATES

67972 Electron spin polarized tunneling study of ferromagnetic thin films. R.Meservey, P.M.Tedrow, J.S.Moodera (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.1-6 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The development of spin-polarized electron tunneling is reviewed beginning with the spin properties of superconductors. Previous results on ferromagnetic films of the transition metals and the heavy rare earth metals are briefly summarized. Spin polarization results of the proximity effect in Ni and Fe films are given. Recent work on artificial tunnel barriers of amorphous Si and Al_2O_3 is described and high quality spin-polarized tunneling curves are presented for Ni using an artifiical Al_2O_3 barrier. Application of the technique to resolving the spin densities of states of superconductors is presented. Ferromagnetic-ferromagnetic tunneling is discussed. (40 refs.)

67973 Calculation of magnetic moment distributions in multilayered films. N.Hamada, K.Terakura (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan), A.Yanase.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.7-8 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
Self-consistent band-structure calculation is effective to study the magnetic moment disribution near the interface of a multilayered film. In an artificial crystal consisting of five Fe and three V atomic planes, the magnetic moment is disturbed strongly in the first atomic planes on the interface. (5 refs.)

67974 Spin polarization of Ni overlayers on an Al(100) substrate. N.Tateno, T.Kambara, K.I.Gondaira (Univ. of Electro-Communications, Tokyo, Japan), Y.Isshiki.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.9-10 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The spin-polarized electronic structures of the two 6-layer (100) slabs, Ni_1Al_5 and Ni_2Al_4 are determined by using the discrete-variational Xα method. The results show that the magnetic moment of the Ni layers in contact with Al is noticeably reduced but not completely suppressed. (10 refs.)

67975 Magnetism of Fe thin films in contact with Al(100) substrate. Y.Isshiki (Tokyo Metropolitan Industrial Tech. Inst., Tokyo, Japan), T.Kambara, K.I.Gondaira.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.11-13 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The spin-polarized electronic structures of the seven-layer (100) slab, Fe_2Al_5 is calculated by using the discrete variational Xα method. The magnetic moment of the interface Fe layer is enhanced but that of the surface Fe layer is hardly affected by the backing with Al. (11 refs.)

67976 Electron spin polarization (ESP) on surfaces and thin films of ferromagnetic metals. C.Rau, S.Eichner (Sektion Phys., Univ. of Munich, Munich, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.25-7 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The ESP at surfaces of oligatomic epitaxial Ni(100)-layers prepared on Cu(100) and NaCl(100) substrate crystals is determined by electron capture spectroscpy (ESC). No evidence is found for the existence of 'intrinsically magnetic dead layers' at Ni(100) surfaces. ECS measurements at surfaces of antiferromagnetic bulk Cr show that ferromagnetic order exists at 293K ($T_N=310K$) at the topmost atomic layer of the Cr(100)$c(2\times2)$ surface. (18 refs.)

67977 Magnetization of ultra-thin epitaxial Fe films. G.Bayreuther, G.Lugert (Inst. fur Angewandte Phys., Univ. Regensburg, Regensburg, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.50-2 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
Ultra-thin ($2\ Å \leq t \leq 100\ Å$) epitaxial ^{57}Fe films were grown in UHV on epitaxial Ag films. Magnetization, $M(H,T)$ ($H \leq 50$ kG; $2K \leq T \leq 400K$) obtained with a SQUID magnetometer and conversion electron Mossbauer spectra are discussed as a function of film thickness. The magnetic shape anisotropy, the M_s-T relation and the room temperature Mossbauer spectra change drastically when the film becomes thinner than 2 atomic layers. (8 refs.)

67978 Antiferromagnetism of FCC iron films. R.Halbauer, U.Gonser (Angewandte Phys., Univ. des Saarlandes, Saarbrucken, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.55-6 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
In γ-Fe films of the three basic orientations (111), (110) and (100), prepared by epitaxial growth, antiferromagnetic ordering was established at low temperature. (8 refs.)

67979 Magnetic properties of Fe-Ni Invar alloy films. M.Konno (Dept. of Phys., Metropolitan Coll. of Technol., Tokyo, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.57-8 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
A detailed experimental study of the Invar alloy films show that the behaviour of γ-phase Fe-Ni films resembles that of Y-Fe-Ni amorphous film, that is, $\partial M_s/\partial T$ is constant. This phenomenon is discussed by the environmental effect of Fe-Fe pair interaction in the inhomogeneous state. (6 refs.)

67980 Amorphons in thin films. L.Wojtczak, T.Balcerzak (Dept. of Solid State Phys., Univ. of Lodz, Lodz, Poland), J.Mielnicki.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.62-4 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
A description of amorphon properties is given by means of a modified treatment of magnons based on the approach used in the theory of disordered alloys. The present considerations include also the boundary conditions at the surfaces of thin films and allows the authors to discuss the properties of surface amorphons. The results show that the special nature of amorphons is due to differences in the density of states when compared with the case of a crystalline medium. The amorphons are of the type of elementary excitations appearing in inhomogeneous media and become magnons when the medium is translationally invariant. (8 refs.)

67981 Magnetic and magneto-optical properties of bismuth-substituted gadolinium iron garnet films. P.Hansen, K.Witter, W.Tolksdorf (Philips GmbH Forschungslab. Hamburg, Hamburg, Germany).
Phys. Rev. B (USA), vol.27, no.7, p.4375-83 (1 April 1983).
The saturation magnetisation M_s, the uniaxial anisotropy K_u, the optical absorption α, the Faraday rotation θ_F, and the Faraday ellipticity ψ_F of epitaxial garnet films of composition $Gd_{3-x}Bi_xFe_5O_{12}$ have been investigated for $x \leq 1.43$. The temperature dependence of M_s and θ_F have been measured in the range $4.2K \leq T \leq T_C$. The compensation temperature decreases and the Curie temperature increases linearly with the Bi content in accordance with data reported for bismuth-substituted yttrium iron garnets. The contribution of the bismuth to the rotation $\Delta\theta_F/x$ at $\lambda=633$ nm was found to be -23800 deg cm^{-1} and -20600 deg cm^{-1} at $T=4.2$ and 295K, respectively. θ_F has been described in terms of the sublattice magnetisations inferred from the fit of the molecular-field theory to the saturation magnetisation. The extracted magneto-optical coefficients exhibit a nonlinear variation with x for both octahedral and tetrahedral sites. The growth-induced anisotropy shows a linear dependence on x and reaches a value of 1.74×10^4 Jm^{-3} at $x=1.43$. The optical absorption was measured for wavelengths ranging between 500 and 800 nm. (34 refs.)

67982 Magnetic properties of Ni, Fe and Co thin films with sulfur impurities. N.Sulitanu (Facultatea de Fizica, Iasi, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.10, p.945-71 (1982). In Rumanian.
Discusses the preparation of thin films with sulfur impurities, measurement of some magnetic and structural characteristics, thermal treatments, the influence of thiourea on the evolution deposition process of ferromagnetic metals with sulfur impurities, magnetic properties of Ni thin films with sulfur impurities, magnetic properties of Fe thin films with sulfur impurities, and magnetic properties of Co thin films with sulfur impurities. (63 refs.)

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces .... See Entry 64579

Investigation of magnetic films by the anomalous Hall-effect . See Entry 67564

Electron localization and interaction in two-dimensional magnetic films .... See Entry 67808

Films and surfaces of ferromagnetic superconductors .... See Entry 67849

Ferromagnetic pinning of superconducting fluxoids at the contact between Sn and Gd films .... See Entry 67870

Investigation of magnetic after-effect in cobalt-doped thin garnet films .... See Entry 67971

Scattering of volume magnetostatic spin waves by a surface acoustic wave .... See Entry 67988

Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment .... See Entry 68033

Spin-wave resonance in single crystal nickel films .... See Entry 68035

Conversion electron Mossbauer spectroscopy and LEED on epitaxial γ-Fe thin films grown on Cu(100) .... See Entry 68097

Ellipsometric investigation of thin Permalloy films .... See Entry 68342

Thickness dependence of the polar Kerr effect in thin ferromagnetic films .... See Entry 68353

75.70K Domain structure (magnetic bubbles)

67983 Generation and annihilation of vertical Bloch lines in strip domain walls. Mao Ting-De, Li Jing-Yuan, Fan She-Yong, Liu Ying-Lie (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.176-81 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Magnetic domains in a magnetic bubble film have been observed in different bias fields after application of pulsed bias fields. The experimental results indicate that the formation of multifingered domains during the rapid expansion of bubbles is usually accompanied by the generation of a large amount of vertical Bloch lines (VBL). The sign of the VBL has a definite relation to the strength of the bias fields applied. On application of a series of bias pulses which are not very strong, the motion of strip domain heads leads to the generation of a large amount of VBL in the domain walls. The VBL will disappear when the pulsed bias fields are strong enough. (11 refs.)

67984 Magnetic domain structures in CoCr films studied by Lorentz microscopy. M.Ohkoshi, T.Kusuda (Dept. of Electronics, Faculty of Engng., Hiroshima Univ., Higashi-Hiroshima, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L130-2 (March 1983).
Magnetization distribution and behavior of magnetization in CoCr sputtered films of various thickness are studied by high-resolution Lorentz microscopy. The perpendicular component of magnetization increases with increasing film thickness, corresponding to the increase in the Q-value. The dominant mechanism of magnetization reversal changes from the domain wall displacement mode in the 200 Å thick film to the rotational mode in the 1000 Å thick film. In the 600 Å thick film, elongated domains with a kind of cross-tie walls are formed perpendicular to an AC demagnetizing field in the film plane.

67985 Strip domain structure of an open type. A.S.Zhukarev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1815-16 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3195-7 (Oct. 1982). [received: April 1983]
The authors study a stripe domain structure of an open type in a plane-parallel ferromagnetic or ferrimagnetic plate of thickness 2L assuming that the easy magnetization axis is normal to the plane of the plate (the z axis). Stripe domains whose magnetization is parallel or anti-parallel to the z axis are separated by Bloch domain walls, i.e. by walls in which the torsion is small and the rotation of the magnetization vector M is mainly in the plane of the wall (the YZ plane). The assumption about a small torsion angle is justified physically since the wall then carries a smaller 'charge' and has a lower energy. (4 refs.)

Approximate ferromagnetic resonance relations for (111) garnet films .... See Entry 68031

75.80 MAGNETOMECHANICAL AND MAGNETOELECTRIC EFFECTS, MAGNETOSTRICTION

67986 Magnetoelastic properties of yttrium iron garnet doped with Tb^{3+} and Yb^{3+} ions. E.M.Smokotin, G.F.Gusyatskii, A.A.Vetrov, S.A.Volkov (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1589-92 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2809-13 (Sept. 1982). [received: April 1983]
The magnetoelastic properties of yttrium iron garnet doped with Tb^{3+} and Yb^{3+} ions were investigated. The measurements were made by a resonance method in the interval 4.2-300K. Strong anomalies of the magnetoelastic behavior of the investigated crystals were observed for definite magnetization directions at low temperatures. (16 refs.)

67987 Effect of a weak magnetic field on the acoustic properties of terbium near magnetic phase transitions. D.I.Anikeev, L.K.Zarembo, S.N.Karpachev (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1665-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2938-41 (Oct. 1982). [received: April 1983]
The acoustic properties (velocity of sound, damping, and the acoustic nonlinearity parameter) of the rare earth metal terbium were studied in the temperature range 220-240K (longitudinal waves in the direction of the hexagonal c crystal axis) for different values of the applied magnetic field. Anomalous behavior of the acoustic properties of Tb was observed in the vicinity of the Neel (~231K) and Curie (~228K) points. The temperature dependences of the damping and of the acoustic nonlinearity parameter of Tb were found to differ considerably for the measurements performed during the cooling and heating of a sample. The magnitude of the nonlinearity parameter Γ in the neighbourhood of a transition from the paramagnetic to the antiferromagnetic phase was approximately ten times greater than for most metals. (5 refs.)

67988 Scattering of volume magnetostatic spin waves by a surface acoustic wave. A.M.Mednikov, S.A.Nikitov, A.F.Popkov.
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1702-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3008-13 (Oct. 1982). [received: April 1983]
A theoretical and experimental study was made of the propagation of volume magnetostatic spin waves in an yttrium iron garnet film in the presence of a surface acoustic wave of much lower frequency. A strong collinear scattering of the spin wave was observed in narrow resonance regions (nontransmission bands), where the conditions for it to be inelastically scattered by the surface wave were satisfied. As well as the interaction of like modes, scattering with transformation of various spin wave volume modes was also observed. The width of the nontransmission band in the spin wave natural frequency spectrum in the presence of the surface acoustic wave was calculated. The calculation was compared with the experimental results. (11 refs.)

67989 Magnetoelastic effect in the excitation of the steel by elastic oscillations. L.S.Pravdin (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.613-17 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.39-44 (Aug. 1982). [received: April 1983]
Investigations were conducted into the dependence of the magnetoelastic variable and constant relaxation irreversible changes in induction due to the magnetic field in steel elastic wave. The qualitative agreement of these dependences with the dependence of the magnetoelastic reversible and irreversible increments of induction on the field in the quasistatic application of stresses has been established. The effect of the excitation of the specimens by elastic oscillations at resonance frequency on the dependence of alternating induction on their hardness was examined on steel U8 specimens. The unambiguous dependence of the irreversible variation of induction on the hardness of the specimens of the U8 and 30KhGS steels was obtained. (5 refs.)

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces .... See Entry 64579

Study of the structural evolution in metallic glass $Fe_{83}B_{14}Si_{1.5}C_{1.5}$ by measuring internal friction and Young's modulus .... See Entry 66890

Simple scaling behaviour in the magnetic susceptibility of $CeSn_3$ under high pressure .... See Entry 67892

Effects of random fields on the phase diagram of $Mn_{0.875}Zn_{0.125}F_2$ .... See Entry 67921

Basic properties of grain-oriented electro-technical steels. Vol. II: Flux distribution and waveforms .... See Entry 67950

Influence of a coating on the domain structure of highly textured electrical-engineering steel .... See Entry 67953

Deformation-induced domains in antiferromagnets .... See Entry 67957

Ferroelectromagnets .... See Entry 68133

75.90 OTHER TOPICS IN MAGNETIC PROPERTIES AND MATERIALS

67990 Surface magnetic properties of amorphous ferromagnets studied using electron spin polarization. D.T.Pierce, R.J.Celotta, J.Unguris (NBS, Washington, DC, USA), H.C.Siegmann.
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.28-30 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The temperature dependence of the surface magnetization of $Ni_{40}Fe_{40}B_{20}$ was determined by measurement of the intensity asymmetry after scattering a spin modulated incident electron beam. The energy dependence of the spin polarization of secondary electrons from $Fe_{81.5}B_{14.5}Si_4$ was measured and illustrates a new way to investigate surface magnetic microstructures. (8 refs.)

Theory of chemisorption on surfaces of ferromagnetic metals .... See Entry 67348

Electronic structure and magnetism of surfaces and interfaces .... See Entry 67716

76.00 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT

(for measurement techniques, see 07.58)

Nonlinear quantum acoustics ....See Entry 66421

76.20 GENERAL THEORY OF RESONANCES AND RELAXATION

67991 Dipolar correlation function and motional narrowing in finite two-dimensional spin systems. J.-P.Korb, D.C.Torney, H.M.McConnell (Stauffer Lab. for Phys. Chem., Stanford Univ., Stanford, CA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5782-9 (1 May 1983).
A statistical treatment is used to describe the dipole-dipole relaxation processes of spins $S=1/2$ diffusing on finite two-dimensional ($2D$) surfaces. This leads to a general expression for the dipolar correlation function $G(\tau)$ including pairwise autocorrelation and cross-correlation terms. The authors show that for a finite $2D$ planar surface, $G(\tau)$ decays faster than that for an infinite planar surface. For finite $2D$ planar surfaces, dipolar translational correlation times, $\bar{\tau}_c$ are expressed in terms of the diffusion coefficient, the distance of closest approach between spins, and the area of the surface. It is shown that there is rapid motional line shape narrowing for sufficiently small two-dimensional surfaces. The calculation of resonance line shapes for the infinite $2D$ surface is discussed, but remains an unsolved problem when the only relaxation processes are those that arise from intermolecular dipolar interactions. (23 refs.)

Effect of anharmonic lattice vibrations on the interaction of spins via a phonon field ....See Entry 67128

76.30 ELECTRON PARAMAGNETIC RESONANCE AND RELAXATION

67992 Modulation spectrum from an electron-spin-resonance line. B.Rakvin, T.Islam, I.Miyagawa (Dept. of Phys. & Astron., Univ. of Alabama, University, AL, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1313-15 (25 April 1983).
A new type of spectrum was obtained from an inhomogeneously broadened ESR line under multiple modulation when one of the modulation frequencies was swept. Each spectral line appeared to be equivalent to the individual spin packet of the ESR line. (12 refs.)

Dynamical averaging of two symmetry-related magnetic resonance tensors in single crystals ....See Entry 64926

76.30D Ions and impurities: general

67993 The nature of the Jahn-Teller effect in the copper-doped hexaimidazole zinc dichloride tetrahydrate complex. C.P.Keijzers, T.Jansen, E.de Boer, G.van Kalkeren (Dept. of Phys. Chem., Univ. of Nijmegen, Nijmegen, Netherlands).
J. Magn. Resonance (USA), vol.52, no.2, p.211-20 (April 1983).
The $Cu(Im)_6^{2+}$ (Im=imidazole) ion doped into the triclinic zinc host crystal $Zn(Im)_6Cl_2.4H_2O$ was reexamined with X-and Q-band single-crystal EPR spectroscopy over the temperature range 4 to 300K. Contrary to the earlier study, which characterized this system as an example of Jahn-Teller tunneling between three tetragonally elongated configurations, it was found from the authors' more extensive measurements, that the $Cu(Im)_6^{2+}$ ion represents an example of strong Jahn-Teller coupling. Below the transition temperature from dynamic to static behavior, two wells in the 'Mexican hat' potential energy surface are preferentially and almost equally occupied. The g and hyperfine tensors for these two sites are consistent with the tetragonally elongated geometry typically found for the static Jahn-Teller effect in CuL_6^{2+} systems. At higher temperatures the third site becomes populated leading to a near isotropic spectrum at room temperature. Measurement of the variation of g and hyperfine coupling with temperature leads to an approximate value of 100 to 150 cm^{-1} for the height of the barrier separating this third site from the two lower energy sites. Examination of the structure of the host crystal allows an understanding of the observed EPR behavior. (15 refs.)

76.30F Iron group (3d) ions and impurities (Ti-Cu)

67994 Ground state wavefunction of copper(II) in 2,2′,2″-triaminotriethylamineisothiocyanatozinc(II) matrix. B.A.Sastry, S.Md.Asadullah (Molecular & Solid State Phys. Lab., Phys. Dept., Osmania Univ., Hyderabad, India), G.Ponticelli.
Indian J. Pure & Appl. Phys., vol.20, no.12, p.996-8 (Dec. 1982). [received: April 1983]
EPR studies have been carried out on the polycrystalline sample of copper-doped 2,2′,2″-triaminotriethylamineisothiocyanatozinc(II) at X- and Q-band frequencies, to obtain the spin-Hamiltonian parameters. The site symmetry of copper(II) in the abovel matrix is found to be compressed trigonal bipyramidal characterized by the following spin-Hamiltonian constants: $g_x=2.193$, $g_y=2.100$, $g_z=2.034$, $A_x=104.0\times M10^{-4}$ cm^{-1}, $A_y=93.3\times10^{-4}$ cm^{-1} and $A_z=107.6\times10^{-4}$ cm^{-1}. The ground state wavefunction calculated from the above parameters comes out to be: $\psi^{\alpha}=0.9932|z^{2\alpha}> +0.1045|x^2-y^{2\alpha}> +i0.0406|xy^{\alpha}> -i0.0275|yz^{\beta}> -0.0159|xz>$. (18 refs.)

67995 ESR study of the normal-incommensurate phase transition in $Sr_2Nb_2O_7$. Y.Akishige, T.Kubota, K.Ohi (Dept. of Phys., Waseda Univ., Tokyo, Japan).
J. Phys. Soc. Jpn. (Japan), vol.52, no.4, p.1290-7 (April 1983).
Temperature dependence of ESR line shape associated with Fe^{3+} in $Sr_2Nb_2O_7$ has been studied. The line shape is analyzed in terms of the incommensurate modulation of the fine structure tensor (D and E). The plane wave modulation model is a good approximation in the temperature range from 220°C to 120°C. The critical index β for the amplitude of the modulation wave is 0.34 ± 0.02 in the temperature range. Below 120°C, the soliton model is a good description for the modulation wave. (16 refs.)

67996 Structural phase transition study of $NiCl_2H_2O$ by EPR. K.R.Juraitis, J.B.Domiciano (Dept. de Fisica, Univ. Estadual de Londrina, Londrina, Brazil), W.Sano.
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.531-3 (1983).
A single EPR line of isotropic and Lorentzian form was observed in a crystal of $NiCl_2H_2O$ between 113 and 300K. During a cooling run a sudden line broadening was observed at 200K associated with a known crystallographic phase transition. On heating, the corresponding transition temperature was 220K. The EPR spectra are interpreted in terms of a modified Anderson and Weiss model. The crystal field parameter is determined as D=0.81K and D=1.07K above and below the transition temperature, respectively. (10 refs.)

67997 An ESR study of phase transitions in crystals of $M(BF_4)_2.6H_2O$ (M=Fe, Co, Ni, Zn). A.K.Jain, M.Geoffroy (Dept. of Chem. Phys., Univ. of Geneva, Geneva, Switzerland).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.525-48 (1983).
From a temperature dependent ESR study of Mn^{2+}-doped crystals of $M(BF_4)_2.6H_2O$, M≡Zn, Co and Ni, new structural phase transitions have been detected and studied. First order structural phase transitions occur in $Co(BF_4)_2.6H_2O$ at $T_1\sim281K$, $T_2\sim189K$ and $T_3\sim172K$ (during cooling), in $Zn(BF_4)_2.6H_2O$ at $T_1\sim286K$ and in $Ni(BF_4)_2.6H_2O$ at $T_1\sim301K$. A continuous phase transition occurs in $Co(BF_4)_2.6H_2O$ at $T_p\sim257K$, in $Zn(BF_4)_2.6H_2O$ at $T_p\sim277$ K and in $Ni(BF_4)_2.6H_2O$ at $T_p\sim294K$. The ESR spectral characteristics suggest similarities in the structures of these fluoroborate compounds in the phase above T_1 with the room temperature structure of $Mg(ClO_4)_2.6H_2O$. All these compounds are found to have a tendency to crystallise in a triply-twinned pseudo-hexagonal form, although the unit cell above T_1 is found to be orthorhombic. The structural changes related to the water octahedron around the metal at T_1 were found to be very small and basically the same for these three compounds. Although the unit cell structure of $Fe(BF_4)_2.6H_2O$ above the first phase transition temperature T_1 was found to be similar to that of the other fluoroborate compounds, the structural changes occurring at T_1 appeared to be quite different. The low temperature thermal behaviour differs considerably in the Co, Fe and Zn compounds. (30 refs.)

67998 EPR detection and study of new phase transitions in $Mg(ClO_4)_2.6H_2O$. A.K.Jain (Dept. of Phys. & Math., Indian School of Mines, Dhanbad, India), G.C.Upreti.
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.549-57 (1983).
A temperature dependent EPR study of Mn^{2+} impurity-doped crystals of $Mg(ClO_4)_2.6H_2O$ has led to the detection of two critical temperatures $T_1\sim335K$ and $T_2\sim324K$ where the EPR characteristics undergo distinct changes. The monoclinic distortion of the water octahedron around the metal ion shows little temperature dependence between T_1 and T_2, and T_2 and $T_3\sim272K$, while it is found to be comparatively strongly temperature dependent above T_1 and below T_3, decreasing as T approaches T_1 from the high temperature side and as T approaches T_3 from the low temperature side. At room temperature the water-perchlorate symmetry seems to deviate slightly from the perfect $P6_3mc$ symmetry proposed from previous X-ray measurements by West. Although the space symmetry group of the unit cell appears to remain unchanged at T_1 and T_2, the temperatures T_1 and T_2 are suspected to be related to structural phase transitions in this crystal. (26 refs.)

67999 ESR study of the structure of Fe (III) in silicate glasses of different basicities. B.Camara (Inst. fur Werkstoffwissenschaften III, Univ. Erlangen, Nurnberg, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.165-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Li, Na, K, Cs silicate glasses which contain various iron concentrations were investigated by ESR. The basicity of these glasses was also determined. The systematic behaviour of Fe^{3+} in these glasses shows clearly that the resonance g=4,2 represents Fe^{3+} in 'tetrahedral' coordination and g≈2 Fe^{3+} in 'octahedral' position. (11 refs.)

68000 ESR of Fe^0 and Cr^0 impurities in silicon for arbitrary SHF power levels. A.A.Bugai, V.M.Maksimenko, E.V.Mozdor, A.B.Roitsin.
Kvantovaya Elektron., Kiev (USSR), no.23, p.53-64 (1982). In Russian.
Theoretically and experimentally investigates the ESR spectra of Fe^0 and Cr^0 in Si at arbitrary levels of incident SHF radiation and at various temperatures. The parameters of ESR spectral lines corresponding to high power levels of the incident electromagnetic waves and to the forbidden transition ($\Delta M=+2$) are studied. (24 refs.)

68001 Vacuum annealing effects in lithium niobate. J.L.Ketchum, K.L.Sweeney, L.E.Halliburton (Phys. Dept., Oklahoma State Univ., Stillwater, OK, USA), A.F.Armington.
Phys. Lett. A (Netherlands), vol.94A, no.9, p.450-3 (4 April 1983).
A series of undoped $LiNbO_3$ crystals have been subjected to heat treatments in a reducing atmosphere, i.e. a vacuum. Electron spin resonance spectra of Fe^{3+} and Mn^{2+} ions, infrared absorption of OH^- molecules, and optical absorption peaking near 500 nm were observed to change as a function of annealing temperature. After reduction above 700°C, subsequent optical bleaching near 77K significantly enhanced a Nb^{4+} electron spin resonance spectrum. (18 refs.)

68002 Absorption spectra of Ti^{3+} in titanite. K.B.N.Sarma, B.J.Reddy, S.V.J.Lakshman (Spectroscopic Labs., S.V. Univ., Tirupati, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.636-41 (Nov. 1982). [received: April 1983]
Optical and ESR absorption studies are reported on titanite. From the ESR spectrum of the sample, the g-factors are measured. (16 refs.)

68003 Electron paramagnetic resonance and ENDOR studies of Cr^{3+}-Al^{3+} pairs in forsterite. L.V.Bershov (Acad. of Sci., Moscow, USSR), J.-M.Gaite, S.S.Hafner, H.Rager.
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.95-101 (1983).
The electron paramagnetic resonance (EPR) spectrum of Cr^{3+} in synthetic crystals of forsterite consists primarily of lines of Cr^{3+} 'isolated' at the $M1$ and $M2$ positions in a 'perfect' crystal environment without local charge compensation. In addition it shows two nonequivalent superhyperfine-split sextets with different intensities which are due to strong interaction of the Cr^{3+} electron spin S ($S=3/2$) with an adjacent nuclear spin I($I=5/2$). Electron nuclear double resonance (ENDOR) experiments revealed that the sextets result from Cr^{3+} ($M1$)-Al^{3+} and Cr^{3+}($M2$)-Al^{3+} pairs, Al being located at adjacent tetrahedral Si sites. The **g**, **D**, **A**, and **A′** tensor components of the Cr^{3+}-Al^{3+} pairs have been determined at room temperature. The values of the pairs are distinct although they are not very different from the corresponding data of 'isolated' Cr^{3+}. From the intensities of the EPR spectra the relative concentration of the Cr^{3+}-Al^{3+} pairs with respect to 'isolated' Cr^{3+} has been estimated. (19 refs.)

68004 Spin-lattice relaxation of Fe^{3+} in cubic ZnS. V.Ya.Bratus', Yu.G.Semenov (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1615-16 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2849-51 (Sept. 1982). [received: April 1983]
The authors clarify the causes of the observed shortening of the spin-lattice relaxation times of Fe^{3+} in cubic ZnS and determine the relaxation mechanisms in the range of one- and two-phonon processes. (10 refs.)

68005 EPR of Mn^{2+} in the *N*, *R*, and *Q* phases of sodium niobate. I.N.Geifman, I.P.Bykov, B.K.Krulikovskii (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukrainian SSR).

Sov. Phys.-Solid State (USA), vol.24, no.10, p.1793-4 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3161-3 (Oct. 1982). [received: April 1983]

Sodium niobate displays the most complex behavior of the known perovskite ferroelectrics, having both antiferroelectric and ferroelectric states. Above 914K it is a paraelectric. As the temperature is lowered the crystal undergoes a series of structural phase transitions. The authors present the results of EPR studies of NaNbO$_3$:Mn^{2+} in the N, R and Q phases. (12 refs.)

Doping of amorphous silicon by implantation of manganese ions .... See Entry 66849

Structural study of aluminium fluoroberyllate glasses .... See Entry 66876

Kinetics of strain-induced reorientation of zinc-sulfide and zinc-selenide crystal structures .... See Entry 67097

Amorphous barium vanadates doped with transition metals ..... See Entry 67610

Paramagnetic centers in α-LiIO$_3$ single crystals activated with nickel .... See Entry 68020

Spectroscopic properties of transition elements in glasses of geological interest .... See Entry 68274

76.30H Platinum and palladium group (4d and 5d) ions and impurities (Zr-Ag and Hf-Au)

68006 ESR of Mo^{5+} in Na$_2$Mo$_2$O$_7$ single crystals. V.S.Grunin, I.B.Patrina, Z.N.Zonn (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., Leningrad, USSR).

Sov. Phys.-Solid State (USA), vol.24, no.9, p.1621-3 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2859-61 (Sept. 1982). [received: April 1983]

The authors consider the Mo^{5+} ESR spectra of Czochralski grown Na$_2$Mo$_2$O$_7$ at 77K. There are no paramagnetic centers in the initial single crystals. Reduction in a CO atmosphere leads to the appearance of electrons in the molybdenum sublattice. Three types of Mo^{5+} ion were observed depending on the form of the impurity and the reduction temperature. Only the spectrum of Mo$_1$$^{5+}$ ions was observed in the impurity-free single crystals and in single crystals with WO$_3$ impurity. It consists of an intense central line and six satellites, corresponding to the odd isotopes ^{95,97}Mo (I=5/2) with close nuclear magnetic moments. (7 refs.)

76.30K Rare-earth ions and impurities

68007 Electron spin resonance of Gd^{3+} in triacetate tetrahydrates of Sm, Nd, Er, Y, Yb, and Dy. S.K.Misra, M.Bartkowski, P.Mikolajczak (Phys. Dept., Concordia Univ., Quebec, Montreal, Canada).

J. Chem. Phys. (USA), vol.78, no.9, p.5369-72 (1 May 1983).

An EPR study of Gd^{3+}-doped single crystals of triacetate tetrahydrates of Sm, Nd, Er, Y, Yb, and Dy has been made in order to study the sytematics of EPR spectra in these homologous isostructural hosts at various temperatures. The absolute signs of the spin Hamiltonian parameters are determined from intensities of lines at liquid helium temperatures. The parameters are evaluated using a rigorous least-squares fitting procedure. As far as the systematics of the parameters are concerned, it is found that while the parameter b_2^2 varies linearly, the parameter b_2^0 varies approximately linearly with the atomic radius of the host rare-earth ion. The EPR studies presented here suggest a monoclinic symmetry at the site of the rare-earth ions in the rare-earth triacetate tetrahydrate crystals investigated. As well, all rare-earth sites are found to be magnetically equivalent. The EPR data also suggest that the Nd host undergoes some structural change at about 238K. (17 refs.)

68008 Paramagnetic species in NaCl:Ca,Cu crystals irradiated at RT. N.Takeuchi, K.Inabe, S.Nakamura (Faculty of Technol., Kanazawa Univ., Kanazawa, Japan).

Phys. Status Solidi b (Germany), vol.116, no.1, p.K5-8 (1 March 1983).

Color centers formed in LiF:Mg, Ti(LiF TLD-100) crystals are considered to be intimately related to their thermoluminescence (TL) properties. The authors examine the paramagnetic species in γ-irradiated NaCl:Ca, Cu crystals by ESR measurements with the hope that through this study some information to help the understanding of the TL mechanism in LiF TLD-100 could be obtained. (6 refs.)

68009 Superhyperfine interaction of an Nd^{3+} tetragonal center in a calcium fluoride single crystal. R.P.Akhaladze, B.G.Berulava, R.I.Mirianashvili, O.V.Nazarova, T.I.Sanadze (State Univ., Tbilisi, USSR).

Sov. Phys.-Solid State (USA), vol.24, no.10, p.1669-72 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2946-51 (Oct. 1982). [received: April 1983]

The RF discrete saturation (RFDS) method was used to study the superhyperfine (SHF) interaction of an Nd^{3+} tetragonal center in a calcium fluoride single crystal. The magnitudes and signs of the tensor components were found for the SHF interaction with fluorine nuclei in the first and second coordination spheres and with the nucleus of a charge-compensating fluorine ion. The SHF interaction parameters are proposed for the first time for noncubic centers, and are used in a qualitative treatment of covalence effects in the Nd^{3+} SHF interaction in calcium fluoride, as well as in a comparison with the SHF interaction of the isoelectronic actinide ion U^{3+} in the same host material. From the results, local distortions of the lattice near Nd^{3+} are determined, which result from the replacement of a lattice cation by an Nd^{3+} ion and from the acquisition of the charge-compensating fluorine ion; the characteristic parameters of these distortions are determined. (12 refs.)

68010 The EPR spectrum of neodymium in crystals of the scheelite series at high pressure. S.V.Kasatochkin (Inst. of High-Pressure Phys., Acad. of Sci., Troitsk, USSR).

Sov. Phys.-Solid State (USA), vol.24, no.10, p.1800-1 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3172-4 (Oct. 1982). [received: April 1983]

The crystal field splitting of the ground state of CaWO$_4$ and CaMoO$_4$ have been studied using Nd^{3+} EPR spectra. The dependence of the g-factor on Nd-O interatomic distance is studied by varying the applied hydrostatic pressure. (10 refs.)

68011 ESR and spin-lattice relaxation of Nd^{3+} in silicates of various structures. I.N.Kurkin, K.P.Chernov (Ul'yanov (Lenin), Kazan.Kazan Univ.,USSR).

Sov. Phys. J. (USA), vol.25, no.7, p.610-12 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.35-8 (July 1982). [received: May 1983]

ESR studies have been made on Nd^{3+} in certain orthosilicate and pyrosilicate single crystals. It is found that Nd^{3+} ions produce a type of activator center, and the principal values of the chief factors have been measured. The ESR spectra are compared with structural data on the crystals. The spin-lattice relaxation gives the positions of the nearest excited Stark level of Nd^{3+} in the silicates. (6 refs.)

76.30L Other ions and impurities

(for colour centres, see 76.30M)

68012 ESR studies of radiation-induced tin centers in oxide glasses. H.Kawazoe (Dept. of Industrial Chem., Tokyo Metropolitan Univ., Tokyo, Japan), J.Nishii, H.Hosono, T.Kanazawa, H.Imagawa.

J. Phys. Colloq. (France), vol.43, no.C-9, p.155-8 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Electronic and geometrical structures around Sn^{2+} and Sn^{4+} dissolved in 25Na$_2$0.75SiO$_2$ glass were determined by use of the photon-induced defects centered on a tin atom as an ESR probe. A trapped electron center (Sn^{2+})$^-$ and trapped hole center (Sn^{4+})$^-$ were detected in the glasses prepared under reducing or oxidizing condition, respectively. The precursor ion Sn^{2+} was found to be in tetragonally pyramidal coordination, the lone pair on Sn^{2+} occupying sp^n type hybrid. Sn^{4+} was considered to be in an ionic coordination of spherical symmetry. (13 refs.)

68013 ESR studies on stereochemistry of thallous ion in oxide glasses. H.Hosono, Y.Abe, H.Kawazoe (Dept. of Inorganic Materials, Nagoya Inst. of Technol., Nagoya, Japan).

J. Phys. Colloq. (France), vol.43, no.C-9, p.159-63 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

The stereochemistry of Tl$^+$ in a wide variety of oxide glasses has been elucidated by analyzing ESR spectra of γ-induced paramagnetic Tl^{2+} employing a newly developed solution to the spin-Hamiltonian. It has been found that there exist two types of the coordination, Tl$^+$ with a nearly spherical-symmetric ligand coordination has appeared in the glasses where bridging and non-bridging oxygen coexist. The Tl^{2+} center produced from coordination II has relaxed into the center similar to that from coordination I on thermal annealing of as-irradiated specimens. A structural model involving the displacement of alkali ion has been proposed on the basis of the kinetical analysis of the conversion. (7 refs.)

68014 ESR studies on arsenic-associated centers in oxide glasses produced by gamma-irradiation. H.Imagawa, H.Hosono, H.Kawazoe (Toshiba Res & Dev. Center, Toshiba Corp., Kawasaki, Japan).

J. Phys. Colloq. (France), vol.43, no.C-9, p.169-72 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Two kinds of new As-associated centers in γ-irradiated 16Na$_2$O.11CaO.73SiO$_2$:0.1AsO$_x$ glass were identified by ESR experiments. The nearly isotropic hyperfine quartet produced by a ^{75}As nucleus (I=3/2, N.A.≒100%) appearing in oxidized glass (O-signal) was assigned to an electron-trap center originating from a precursor As^{5+} ion. The HF quartet of axial symmetry observed in reduced glass was attributed to a hole-trap center originating from an As^{3+} ion. ESR parameters were evaluated by use of a line shape simulation technique. LCAO coefficients were derived from the parameters. The structure models for the centers were proposed on the basis of the coefficients: the electron-trap center, (As^{5+})$^-$, has a tetrahedral coordination, the trapped electron locating on an As-O antibonding MO; the hole-trap center, (As^{3+})$^+$, has a trigonally pyramidal coordination, the hole occupying a nonbonding As sp^3 hybridized orbital. (17 refs.)

68015 ESR studies of donor clusters in silicon. D.New, T.Castner (Dept. of Phys. & Astron., Univ. of Rochester, Rochester, NY, USA).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.128-30 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

ESR spectra for Si:P and Si:As samples with donor concentrations ranging from 9×10^{16} to 5×10^{17}/cc have been obtained in the range 4.2K to 20K at 9 GHz. d_χ''/dH spectra were integrated to obtain χ''(N,T,H) allowing the determination of relative contributions from different size clusters. The ratio of integrated intensity of the outer lines to the total integrated intensity obeys Poisson statistics and yields a characteristic volume V_c for Si:P of 8.21×10^6 Å^3. A search outside the isolated donor hyperfine lines has revealed no extra transitions 0.03% of the outer hyperfine lines. A new many-electron cluster hyperfine interaction is formulated which takes account of topological disorder for larger clusters. The effect of hyperfine topological broadening and cluster-cluster interactions on the ESR line widths and shapes are considered. (11 refs.)

Unusual sequence of commensurate-incommensurate phase transitions observed in KLiSO$_4$ .... See Entry 67197

Distribution of recombination lifetimes in doped a-Si:H .... See Entry 67642

Dependences of ESR and electrical properties on P doping ratio for microcrystalline Si .... See Entry 67816

Incorporation scheme of H reducing defects in a-Si studied by NMR and ESR .... See Entry 68050

76.30M Colour centres and other defects

68016 Vacancy centers in single crystals in Bi$_{12}$RO$_{20}$(R=Si, Ti, Ge). A.P.Eliseev, V.A.Nadolinnyi, V.A.Gusev (Inst. of Inorganic Chem., Acad. of Sci., USSR).

J. Struct. Chem. (USA), vol.23, no.3, p.484-5 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.181-2 (May-June 1982). [received: Feb. 1983]

The crystals of oxygen-containing compounds of bismuth Bi$_{12}$RO$_{20}$ with Si, Ti, and Ge as the second metal R, belonging to the acentric class 23 of the cubic system (sillenite structure) are at present regarded as promising materials for extensive application in optoelectronic instruments, in particular in systems for the optical memorization, processing, and storage of information. An important task in the improvement of the characteristics of these instruments is the determination of the nature of the local centers reponsible for definite parameters. EPR and optical spectroscopy have been used to study the nonalloyed industrial crystals grown by the Czochralski method from a melt with the stoichiometric composition and containing, according to spectral analysis data, not more than 10^{-4} wt.% impurity. (4 refs.)

68017 Electronic spin of the Ga vacancy in GaP. T.A.Kennedy, N.D.Wilsey, J.J.Krebs, G.H.Stauss (Naval Res. Lab., Washington, DC, USA).

Phys. Rev. Lett. (USA), vol.50, no.17, p.1281-4 (25 April 1983).

EPR experiments with uniaxial stress on the Ga vacancy V_{Ga} in GaP reveal that its spin is $^3/_2$. The spectrum splits linearly with stress into three components with a coefficient $C_{11}=34\times10^{13}$ cm^{-1} (dyn/cm^2)$^{-1}$ at 20K. The high spin demonstrates the importance of the exchange interaction for this vacancy. (16 refs.)

68018 The AsO_4^{4-} center in CsH_2AsO_4: a Halperin-Varma defect moving in a single well potential. P.S.S.Guimaraes, R.Gazzinelli, G.M.Ribeiro, A.S.Chaves (Dept. of Phys., Univ. Federal de Minas Gerais, Belo Horizonte, Brazil).
Solid State Commun. (USA), vol.46, no.7, p.513-16 (May 1983).
The ESR of the AsO_4^{4-} center in CsH_2AsO_4 is investigated from 4.2K to 270K. The behavior of this paramagnetic center is essentially different from its behavior in the other members of the KDP family. Two properties of the center are remarkable: it seems to behave like a Halperin-Varma kind of defect and to move classically in a single-well potential which can be represented to a very good approximation by a square well. (19 refs.)

68019 Investigation of dislocations in silicon by the ESR method. V.V.Kveder, Yu.A.Osip'yan (Inst. of Solid-State Phys., Acad. of Sci., Chernogolovka, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1246-8 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1930-3 (Nov. 1982). [received: April 1983]
The main results of an investigation of dislocations in silicon by the ESR method are presented briefly. It is shown that plastic deformation creates paramagnetic centers which can be attributed unambiguously to chains of dangling dislocation bonds. A structural transition clearly occurs in such chains below 50K. The available data demonstrate the existence of one-dimensional phonons localized at dislocations. (12 refs.)

68020 Paramagnetic centers in α-$LiIO_3$ single crystals activated with nickel. M.L.Meil'man, V.F.Karyagin, V.O.Martirosyan (All-Union Engng.-Construction Inst. Correspondence School, Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1788-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3154-6 (Oct. 1982). [received: April 1983]
It has been observed that impurities of transition metals (for instance, chromium, iron, nickel, etc.) have a pronounced effect on the properties of α-$LiIO_3$ crystals. Therefore, the study of color centers formed by impurity ions of transition elements is of both scientific and practical interest. The authors report the results of a study of the electron paramagnetic resonance (EPR) spectra of single crystal lithium iodate. The crystals were grown from water solution with an admixture of nickel salts. (6 refs.)

The influence of melting condition on the radiation sensitivity of GeO_2 glass ....See Entry 66873

Paramagnetic species in NaCl:Ca,Cu crystals irradiated at RT ....See Entry 68008

ESR studies of radiation-induced tin centers in oxide glasses . See Entry 68012

ESR studies on arsenic-associated centers in oxide glasses produced by gamma-irradiation ....See Entry 68014

Incorporation scheme of H reducing defects in a-Si studied by NMR and ESR ....See Entry 68050

76.30P Conduction electrons

68021 Theoretical and experimental studies of uniaxial stress enhanced spin-flip transitions in n-InSb. M.Kriechbaum (Inst. of Theoretical Phys., Univ. Graz, Graz, Austria), R.Meisels, F.Kuchar, E.Fantner.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.444-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Theoretical and experimental studies concerning spin-flip transitions of conduction band electrons in pure InSb under uniaxial stress in different crystallographic orientations are presented. From the magnetic field dependence of the $0^+ \rightarrow 0^-$ transition a zero-field value of -51 is obtained for the effective Lande factor in good agreement with theoretical results. The uniaxial stress enhancement of the spin resonance is strongly anisotropic being very weak for stress X parallel to [100]. From absorption data for $X \| [\bar{1}10]$ a value of 1.6 ± 0.5 eV is obtained for the deformation potential C_2. The variation of g^* on stress is less than about 0.5% at 1 kbar. (9 refs.)

68022 Optical spin orientation. Application to the study of photoelectron kinetics. V.I.Safarov, A.N.Titkov (A.F. Ioffe Phys.-Tech. Inst., Acad. of Sci., Leningrad, USSR).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.497-501 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Recent results obtained with the use of the optical spin orientation method on spin relaxation, recombination and transport of photoelectrons in III-V compounds are presented. (36 refs.)

76.30R Free radicals

68023 An EPR study of the reaction between poly(*p*-phenylene sulfide) and electron-acceptor dopants. L.D.Kispert, L.A.Files (Dept. of Chem., Univ. of Alabama, Tuscaloosa, AL, USA), J.E.Frommer, L.W.Shacklette, R.R.Chance.
J. Chem. Phys. (USA), vol.78, no.8, p.4858-61 (15 April 1983).
EPR spectra for electron-acceptor doped poly(*p*-phenylene sulfide) are reported. The *g* values obtained from these spectra correspond to an electron density centered around a divalent sulfur radical cation R-S-R. This assignment is supported by corresponding EPR data from an oligomeric model compound ϕ-S-ϕ-S-ϕ (ϕ=phenyl). The *g* value of the sulfur-based radical cation of doped poly(*p*-phenylene sulfide) distinctly contrasts the nearly free electron *g* values obtained from EPR measurements on poly(*p*-phenylene) and its oligomer *p*-terphenyl. (19 refs.)

68024 Geometric model of trapped electrons in trehalose single crystals X-ray irradiated at 3K. An EPR study. P.-O.Samskog, L.D.Kispert (Chem. Dept., Univ. of Alabama, Tuscaloosa, AL, USA), A.Lund.
J. Chem. Phys. (USA), vol.78, no.9, p.5790-4 (1 May 1983).
Three different radicals were identified by EPR in X-ray irradiated single crystals of trehalose at 3K. The species are the trapped electron, a hydroxy alkyl radical, and an alkoxy radical. The electron is trapped in an intermolecular site formed by two hydroxyl groups, one on the carbohydrate and the other on a water molecule is evidenced by the anisotropic proton hyperfine couplings. A geometric model for the trapping site is presented. The trapped electron decays by cleavage of an OH bond and the liberated hydrogen atom abstracts another hydrogen atom from an adjacent carbon atom forming a hydroxy alkyl radical. The site of the alkoxy radical has been identified. The primary reaction mechanism is discussed. (16 refs.)

Substituent effects on benzyl radical ESR hyperfine coupling constants. The $\sigma\alpha^{\cdot}$ scale based upon spin delocalization ....See Entry 68767

Electron spin resonance of spin-trapped radicals in γ-irradiated aqueous uracil solutions. Chromatographic separation of radicals ....See Entry 68786

76.40 DIAMAGNETIC AND CYCLOTRON RESONANCES

68025 The cyclotron resonance linewidth in two-dimensional electron accumulation layers in InSe. E.Kress-Rogers, R.J.Nicholas (Clarendon Lab., Oxford Univ., Oxford, England), A.Chevy.
J. Phys. C (GB), vol.16, no.12, p.2439-48 (30 April 1983).
In InSe electron accumulation layers are formed in the vicinity of stacking faults with charged impurities adsorbed to the defect plane. In this two-dimensional system the dependence of the cyclotron resonance linewidth on magnetic field is significantly different from silicon n-channels and from inversion layers at heterojunction interfaces. While in the latter the linewidth is dominated by short-range scattering and thus follows a $B^{1/2}$ dependence, the CR linewidth in InSe does strongly decrease with increasing magnetic field for intermediate fields and saturates for higher fields. This behaviour can be quantitatively described as due to neutral impurity scattering via a gaussian potential with a range comparable with or larger than the cyclotron radius. At high magnetic fields, screened Coulomb scattering and deformation potential scattering also contribute. (21 refs.)

68026 Oscillations of the cyclotron resonance linewidth with Landau level filling factor in GaAs/AlGaAs heterostructures. T.Englert, J.C.Maan, Ch.Uihlein (Max-Planck-Inst. fur Festkorperforschung, Grenoble, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.631-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The linewidth of cyclotron resonance in a 2D electron gas in GaAs/AlGaAs heterojunctions shows oscillations between 0.070 T and 0.32 T as a function of the resonance magnetic field at 5K. With increasing temperature the maximum linewidth decreases, whereas the minimum increases. This oscillatory behaviour is shown to be correlated with the filling factor of Landau levels. (9 refs.)

68027 Far-infrared shifted cyclotron resonance in a charge-density-wave system, $NbSe_3$. R.J.Wagner (Naval Res. Lab., Washington, DC, USA), N.P.Ong.
Solid State Commun. (USA), vol.46, no.7, p.491-5 (May 1983).
Cyclotron resonance studies on the charge-density-wave metal $NbSe_3$ at 2K reveal two types of free carriers (with effective mass 0.18 m_0 and 0.71 m_0 respectively). The measured lifetimes agree with earlier estimates of the DC mobility. An unexplained shift of the resonance field of the form $\omega_0^2+\omega_c^2$ is observed when the laser electric field is polarized perpendicular to the chain direction. (14 refs.)

68028 Observation of oscillatory linewidth in the cyclotron resonance of GaAs-Al_xGa_{1-x}As heterostructures. T.Englert, J.C.Maan, C.Uihlein (Hochfeld-Magnetlabor, Max-Planck-Inst. fur Festkorperforschung, Grenoble, France), D.C.Tsui, A.C.Gossard.
Solid State Commun. (USA), vol.46, no.7, p.545-8 (May 1983).
The linewidth of the far infrared cyclotron resonance in the 2-D electron gas in GaAs-Al_xGa_{1-x}As heterojunctions shows oscillations between 0.070 and 0.32 T as a function of the resonance magnetic field at 5K. With increasing temperature the maximum linewidth decreases, whereas the minimum increases. This oscillatory behavior can be correlated with the filling factor of the Landau levels. (10 refs.)

68029 Cyclotron resonance and impurity absorption in tellurium under pressure in the submillimeter range. M.I.Eremets, S.G.Lyapin, U.Steigenberger, V.G.Veselago, E.A.Vinogradov, E.S.Itskevich, Yu.V.Kosichkin, M.von Ortenberg, A.M.Shirokov (Inst. of High-Pressure Phys., Acad. of Sci., Troitsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1667-8 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2942-5 (Oct. 1982). [received: April 1983]
Submillimeter magnetospectroscopy was used to study the band structure of semiconductors under hydrostatic pressure. The main features of this technique are: (1) the use of a liquid optical constant-pressure chamber with an axial symmetry, (2) recording radiation with a detector placed just behind the sample in the pressurized region, (3) the use of a backward-wave tube as the radiation source. The cyclotron resonance spectra and impurity levels of tellurium were recorded with high resolution at pressures up to 6 kbar. Two groups of impurity lines were found, behaving differently under pressure: this seems to indicate that the acceptor impurities responsible for them are different in physical nature. (10 refs.)

68030 Spin-cyclotron-phonon resonance in semiconductors with inversion asymmetry. A.D.Margulis, Vl.A.Margulis (N.P. Orgarev Mordovian State Univ., Saransk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1713-16 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3026-32 (Oct. 1982). [received: April 1983]
A new mechanism of excitation of a spin-cyclotron-phonon resonance related to a spin flip interaction of electrons with longitudinal optical phonons is studied. The spin-cyclotron-phonon resonance occurs due to a relativistic term in the electron Hamiltonian, which is cubic in the momentum and leads to a spin splitting of the conduction band. The transformation of the electron spectrum caused by a resonance spin-phonon coupling (pinning effect) is discussed. (13 refs.)

Influence of exchange interaction on band structure of $Pb_{1-x}Mn_xTe$ ....See Entry 67445

Cyclotron resonance studies of polarons and screening effects in GaAs ....See Entry 67486

Spin-hot electrons in photoexcited p-type InSb ....See Entry 67628

Electron mobility and Landau level width modulation-doped GaAs-Al_xGa_{1-x}As heterojunctions ....See Entry 67763

Vector potential induced diamagnetism and flux quantization in normal metals ....See Entry 67884

Far-infrared magneto-dynamics of photoexcited electron system in gallium arsenide ....See Entry 68277

76.50 FERROMAGNETIC, ANTIFERROMAGNETIC, AND FERRIMAGNETIC RESONANCES; SPIN WAVE RESONANCE

(see also 75.30D Spin waves)

68031 Approximate ferromagnetic resonance relations for (111) garnet films. M.Marysko (Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B32, no.11, p.1307-10 (1982).
The magnetic anisotropy of (111) garnet films is intensively studied with respect to their bubble domain applications. The measurement of the uniaxial and cubic anisotropy of these films can be performed using ferromagnetic resonance (FMR). In this method the anisotropy fields and g-factor are determined by fitting the calculated out-of-plane angular dependence of the resonance field in the plane $(\bar{1}10)$ in the measured dependence. Cronemeyer et al. (1975) have used this method making use of the simple resonance relations derived on the assumption that the vectors M and H are collinear. Recently, Makimo et al. (1981) have determined the anisotropy fields by numerical computing on the basis of the exact resonance relations derived on the assumption that the vectors M and H are collinear. Recently, Makimo et al. (1981) have determined the anisotropy fields by numerical computing on the basis of the exact resonance relations and have shown that neglect of the noncollinearity can affect the accuracy of determining the cubic anisotropy constant K_1. Approximate analytical resonance relations for the magnetic field rotating in the $(\bar{1}10)$ plane are derived correctly to first order in the angle deviation between M and H. These relations are more accurate than those used by Cronemeyer, and in most cases (for not too large anisotropies) they enable the author to calculate the angular dependences of the resonance field from relatively simple analytical expressions. (4 refs.)

68032 Magnetic resonance in $(C_2H_5NH_3)_2CuCl_4$ at low frequencies. V.N.Vasyukov, A.V.Zhuravlev, S.N.Lukin, V.T.Telepa.
Fiz. Nizk. Temp. (USSR), vol.9, no.4, p.429-32 (April 1983). In Russian. English translation in: *Sov. J. Low Temp. Phys. (USA)*
The frequency-field dependence of the AFMR spectrum of $(C_2H_5NH_3)_2CuCl_4$ is investigated at the temperature 4.2K in the frequency range $\nu=10^{-3}$-2.6 *GHz* and field range 0-2.0 *kOe*. The values of the spin-flop transition field $H_{SF}=305\pm5$ *Oe*, exchange field $H_E=1410\pm10$ *Oe* and activation frequency of AFMR spectrum in zero magnetic field are determined, $\nu_c=1160\pm50$ *MHz*. (11 refs.)

68033 Magnetic and some crystalline properties of H^+ ion-implanted garnet layers: A study as a function of annealing treatment. G.Suran (Lab. de Magnetisme CNRS, Meudon-Bellevue, France), H.Jouve, P.Gerard.
J. Appl. Phys. (USA), vol.54, no.4, p.2006-18 (April 1983).
The magnetic properties—as determined by ferromagnetic resonance (FMR) measurements—lattice strain $\Delta a/a$ and variation of these parameters were studied as a function of annealing temperature T_{ann} in $(YSmLuCa)_3(FeGe)_5O_{12}$ bubble garnet films subjected to a triple implantation by H^+ ions. On the as-implanted sample the FMR spectrum and $\Delta a/a$ could not be measured. On samples annealed at 200°C three resonance peaks appear corresponding to three sublayers with different magnetic properties. The formation of the sublayers is related to the inhomogeneous distribution of H^+ ions along the implanted layer as a result of the triple implantation. For this range of T_{ann} the Curie temperature T_C, $\Delta a/a$, and the anisotropy fields vary strongly with annealing time. This result is related to the high diffusion rate of hydrogen and shows that the magnetic properties are substantially modified by the absorbed H^+ ions. When $T_{ann}>300°C$ the amount of H^+ incorporated becomes negligible, so the magnetic parameters and the value of $\Delta a/a$ are essentially determined by the lattice damage. The implanted layer becomes magnetically homogeneous as shown by a well-defined spin wave spectrum characteristic of a layer with fairly uniform magnetic properties along its thickness. For $300°C<T_{ann}<600°C$ increasing T_{ann} results in a decrease of $\Delta a/a$ and a restoration of the superexchange interaction between the *a* and *d* sites, as shown by the increase of T_C. The resonance linewidth ΔH_1 of the implanted layer is greatly reduced with respect to ΔH_0 of the bulk of the film, due to the fact that a large part of *c* site rare-earth ions are decoupled from the garnet system. As a consequence, K_u is negligible and λ_{111} is strongly reduced in the implanted layer. For $T_{ann}>630°C$ the rare-earth ions are progressively recoupled as shown by the increase of ΔH_1. As a result λ_{111} increases and K_u is partially restored. (27 refs.)

68034 Surface studies of amorphous metallic glass by magnetic resonance (Resonance surface studies of $Fe_{40}Ni_{40}B_{20}$). Z.Frait (Inst. of Phys., Czechosl. Acad. of Sci., Praha, Czechoslovakia).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.37-42 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
Surface layer properties of amorphous ribbons of $Fe_{40}Ni_{40}B_{20}$ were studied by ferromagnetic resonances in the frequency range 9-105 GHz, at room temperature, at both sample surfaces. The values of effective magnetic polarization, g-factor, uniaxial in-plane anisotropy and linewidth parameter, evaluated from these measurements were compared with those pertinent to the interior of the sample obtained by the ferromagnetic antiresonance method. The origin of the observed differences is discussed. The spread of the local surface stray fields has been observed on a medium-range scale ($>1\mu m$) by the EPR of free radical thin layers. (61 refs.)

68035 Spin-wave resonance in single crystal nickel films. A.A.Hussain, J.S.S.Whiting (Dept. of Phys., Univ. of York, York, England).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.59-61 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The effect of substrate material and of sodium fluoride coatings on the pinning of spin-wave modes has been investigated in single crystal nickel films. (6 refs.)

68036 Photoinduced change in SWR spectra of Si-deposited YIG thin films. K.Uematsu, M.Deguchi, Y.Kito (Dept. of Phys., Waseda Univ., Tokyo, Japan).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.65-7 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
The SWR spectra and the photoinduced change of resonant fields in annealed Si-deposited YIG thin films are observed. The presence of the critical angle which changes with irradiation shows that the surface mode is excited. The annealing conditions effective to the change of the surface anisotropy are found. (8 refs.)

68037 Resonance of domain boundaries in single-crystal magnets. S.A.Kirov (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1610-12 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2842-4 (Sept. 1982). [received: April 1983]
The author has measured the dependence of the resonance frequencies of the domain boundaries on the magnetizing field H_0 in a bulk specimen of cubic ferrite. The results, as well as previously reported data, were shown to be satisfactorily explained in terms of a model of uniform rotation of the magnetization vector M inside the domain boundaries. Measurements of the FMR absorption spectra as a function of H_0 were carried out on a spherical monocrystalline specimen of nickel ferrite. (19 refs.)

68038 Paramagnetic and electric geometric resonances in antiferromagnetic semiconductors. I.N.Oleinik, V.L.Fal'ko (Inst. of Radiophys. & Electronics, Acad. of Sci., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1748-51 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3090-5 (Oct. 1982). [received: April 1983]
The paramagnetic properties of antiferromagnetic semiconductors in a strong static magnetic field H_0 and in the field of a strong electromagnetic wave are studied within the *s-d* exchange model. Paramagnetic and electric geometric resonances are predicted and their properties are studied. It is shown that a paramagnetic resonance represents a convenient method for the determination of the exchange interaction constant. (7 refs.)

Existence of an intermediate state in $CuCl_2.2D_2O$ in the AC plane .... See Entry 67907

Magnetoelastic properties of yttrium iron garnet doped with Tb^{3+} and Yb^{3+} ions .... See Entry 67986

Study of the ion distribution and magnetic properties of Y-Ca-In-Ge iron garnet .... See Entry 68099

76.60 NUCLEAR MAGNETIC RESONANCE AND RELAXATION

68039 Investigation of deviations from stoichiometry in copper selenide by the method of nuclear magnetic resonance. V.V.Gorbachev, Yu.B.Muravlev, G.A.Mustafaev (Moscow Inst. of Steel & Alloys, Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.1038-9 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1230-2 (July 1982). [received: Feb. 1983]
The possibility of using the NMR method was studied for the investigation of the characteristics of these copper chalcogenides $(Cu_{2-x}B^{VII})$ that arise when their composition deviates from stoichiometry. The investigations were conducted on crystalline samples of p-type $Cu_{2-x}Se$ with x=0-0.2. Since all the investigated samples possessed relatively large electric conductivity ($\rho\approx2.5\times10^{-5}$ Ω.m), they were pulverized to a particle size that permitted the influence of the skin layer on the shape of the NMR line to be neglected. The measurements were performed at 100 and 300K in a magnetic field with intensity 1.24×10^{-15} A/m. The shape of the NMR line for all the samples of different composition is well described by a Lorentzian curve, which is evidence of the applicability of the theory of Reif and Cohen. According to this theory, the quadrupole interactions that arise at low concentrations of point defects of an impurity lead to a symmetrical shift of the satellite lines and transformation of the Gaussian form of the line to a Lorentzian form. (6 refs.)

68040 A ^2H NMR study of the solid-phase behavior of nonadecane. M.G.Taylor, E C.Kelusky, I.C.P.Smith, H.L.Casal, D.G.Cameron (Nat. Res. Council of Canada, Ottawa, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.5108-12 (15 April 1983).
The ^2H NMR spectra of perdeuterononadecane and several specifically deuterated nonadecanes, in solid phases I (orthorhombic) and II (rotator), are reported. In phase I, the central portion of the chain is static on the time scale of 10^{-5} s; however, the chain ends are subject to torsional motions. In phase II, the chains undergo hindered rotation. The phase II spectra of the methylene groups located in the center of the chain can be simulated with a model in which the rigid chain undergoes 82° jumps between equivalent sites. However, this model is inadequate for the methyl and methylene groups near the chain ends. The data suggest higher amplitudes of torsional motion in these positions. (23 refs.)

68041 NMR study of ^{181}Ta in the commensurate charge density wave state of $1T\text{-}TaSe_2$ and $1T\text{-}TaS_2$. M.Naito, H.Nishihara, S.Tanaka (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
J. Phys. C (GB), vol.16, no.12, p.L387-93 (30 April 1983).
The ^{181}Ta NMR in $1T\text{-}TaSe_2$ and $1T\text{-}TaS_2$ has been studied at 4.2K using single crystals as well as powders in order to obtain detailed information of the superlattice structure in the commensurate charge density wave state. The results are discussed on the basis of the star-shaped cluster model and an effect due to the three-dimensional (3D) order of clusters is pointed out. (10 refs.)

68042 Deuteron NMR lineshape computations for tunnelling ND_4^+ ions. II. Exact treatment of quadrupolar interactions. Z.T.Lalowicz (Radiospectroscopy Div., Inst. of Nuclear Phys., Krakow, Poland), W.T.Sobol.
J. Phys. C (GB), vol.16, no.12, p.2351-62 (30 April 1983).
For pt.I see ibid., vol.11, p.4187 (1978). Effects of tunnelling rotation of ND_4^+ ions on ^2H-NMR lines are analysed. Detailed lineshape calculations are supplied. All terms in the quadrupolar Hamiltonian and secular dipolar interaction between deuterons are taken into account. Asymmetry and level crossing are characteristic features observed in the lineshapes. The latter effect makes measurement of the tunnelling frequency possible. Sets of theoretical lineshapes are presented showing their evolution with tunnelling splitting and with magnetic field. The main conclusion is that complete interpretation of a given ammonium compound (ground torsional level structure and tunnelling splitting value) requires measurement of the field dependence of the ^2H-NMR lineshape. (5 refs.)

68043 Deuteron NMR lineshape computations for tunnelling ND_4^+ ions. III. Level-crossing study for ND_4ClO_4. Z.T.Lalowicz (Radiospectroscopy Div., Inst. of Nuclear Phys., Krakow, Poland).
J. Phys. C (GB), vol.16, no.12, p.2363-73 (30 April 1983).
For pt.II see ibid., vol.16, p.2351 (1983). Deuteron NMR lines were measured in ND_4ClO_4 at 4.2K and at various magnetic fields from 0.63 to 1.48T. A remarkable number of lines were found to exhibit evolution in shape and width. This effect arises from level-crossing between Zeeman and tunnelling systems appearing around 0.85 T and around 1.45T. The theory of ^2H NMR spectra, from previous work, has been applied to the interpretation. Tunnelling splittings were estimated by fitting theoretical lineshapes and were found, for ND_4^+ in ammonium perchlorate, to be reduced by a factor of 304

with respect to those of NH_4. Rotational tunnelling effects in proton and dueteron NMR spectra are compared. (25 refs.)

68044 Anisotropy and asymmetry of the hyperfine spectrum of holmium in magnetically ordered RAl_2 alloys. P.R.Waind, I.S.MacKenzie, M.A.H.McCausland (Dept. of Phys., Univ. of Manchester, Manchester, England).
J. Phys. F (GB), vol.13, no.5, p.1041-56 (May 1983).
The hyperfine interaction of holmium in ferromagnetically ordered RAl_2 compounds has been studied by pulsed NMR at liquid helium temperatures. The seven-line NMR spectrum of ^{156}Ho has been observed in alloys for which the spontaneous magnetisation lies in different crystallographic directions. The measured hyperfine splittings reflect the marked dependence of the ground state of the Ho^{3+} ion on the direction of magnetisation. Results are interpreted in terms of a single-ion effective-field model with no free parameters. Satisfactory agreement between theory and experiment is obtained only when terms of second order in the free-ion hyperfine interaction are included in the calculations. Among the second-order terms is a pseudo-octupole interaction which imparts a measurable asymmetry to the NMR spectra. (30 refs.)

68045 A deuterium NMR study of $D(UO_2XO_4)$, $4D_2O$; X=P, As. T.K.Halstead (Dept. of Chem., Univ. of York, York, England), N.Boden, L.D.Clark, C.G.Clarke.
J. Solid State Chem. (USA), vol.47, no.2, p.225-30 (April 1983).
Deuterium NMR spectra have been obtained by the solid echo technique for polycrystalline samples of DUO_2XO_4, $4D_2O$, with X=P (DUP) and As (DUAs). Transitions (II→I) were found, by DSC measurements, to occur at 260 and 290K for DUP and DUAs, respectively. In the high temperature tetragonal phase *I*, the NMR lineshapes are consistent with motionally averaged axially symmetric electric field gradient tensors, with values for $\langle e^2qQ/h\rangle_{av}$ of 39.2 ± 0.2 and 38.2 ± 0.2 kHz for DUP and DUAs, respectively. This requires fast chemical exchange of the deuterium atoms between all of the hydrogen-bond sites in a water layer, and participation of all of the deuterium atoms in the diffusion process. There are no discernible discontinuities in the spectra at the transition temperature suggesting that there is little change in the local structure of the water layers at the transition. The spectra disappeared at about 10K below T_c and for DUP a distorted broader spectrum became discernible below about 200K. (13 refs.)

68046 A study of polyhedral octa(organosilasesquioxanes) by high-resolution NMR at the ^{13}C and ^{29}Si nuclei in the solid state. L.E.Gorsh, A.A.Shubin, V.M.Nekipelov, A.N.Kanev (Inst. of Inorganic Chem., Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.345-8 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.26-9 (May-June 1982). [received: Feb. 1983]
Polyhedral octa(organosilasesquioxanes) $(RSiO_{1.5})_8$, where r-CH_3, C_2H_5, or C_2H_3, have been studied by high-resolution NMR at the ^{13}C and ^{29}Si nuclei in the solid state. A correspondence has been established between the nonequivalence of the silicon atoms and the distortion of the silicon-oxygen framework of the molecule. An explanation has been given for the nature of the splitting of the signals of the β-carbon atoms in the ^{13}C NMR spectra in the ethyl and vinyl derivatives. (14 refs.)

68047 ^{13}C NMR analysis of propylene-butylene copolymers by a reaction probability model. H.N.Cheng (Hercules Inc., Res. Centre, Wilmington, DE, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.573-81 (April 1983).
^{13}C NMR spectra of propylene-1-butene copolymers have been studied at 90.55 MHz. At this high field many lines previously not resolvable were found to be sensitive to comonomer sequence distribution; these microstructures have been fully assigned. Each NMR spectrum was analysed by a reaction probability model. Information available includes polymer composition, comonomer sequence distribution, and Markovian reaction probabilities. The use of this model reduces errors in the determination of sequence distribution and furthermore enables the product r_1r_2 of the reactivity ratios to be determined for the copolymer/catalyst system.

68048 NMR studies of the structure of glass. P.J.Bray, W.J.Dell (Dept. of Phys., Brown Univ., Providence, RI, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.131-42 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Over the past 25 years, wide-line nuclear magnetic resonance (NMR) techniques have been used successfully to study the structure of glasses on an atomic scale. Analysis of the quadrupolar structure in NMR spectra of borate glasses has yielded quantitative determinations of the relative numbers of boron atoms in various oxygen environments. After a brief discussion of the relevant aspects of NMR theory, the authors present some of the most recent studies: B^{11} NMR in sodium borosilicate glasses of high soda content, B^{10} NMR in lithium borate glasses, and Be^9 NMR in sodium fluoride-beryllium fluoride glasses. (27 refs.)

68049 Wide-line NMR in polymers. P.Tekely (Polska Akad. Nauk, Zaklad Polimerow, Zabrze, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.27, no.4, p.137-42 (April 1982). In Polish. [received: March 1983]
Theoretical principles, methods of interpretation and uses of wide-line NMR spectroscopy for investigations of the phase structure as well as various types of molecular motions in polymers have been discussed. The fields of application of this method in the determination of the degree of crystallinity in polymers in the studies on oriented and cross-linked polymers and on polymer-low-molecular-weight substance systems have been indicated. (91 refs.)

68050 Incorporation scheme of H reducing defects in a-Si studied by NMR and ESR. T.Shimizu, K.Nakazawa, M.Kumeda, S.Ueda (Dept. of Electronics, Kanazawa Univ., Kanazawa, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.926-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
By comparing the results of NMR, ESR and photoconductivity measurements, it is found that dispersed H atoms bonded to Si mainly play a role in reducing the density of dangling bonds N_s. Gathered H and F atoms appear to decrease the mobility. It is also concluded that the decrease in N_s with an increase in substrate temperature T_s does not result from a direct thermal relaxation but from a different H incorporation scheme at a higher T_s. (8 refs.)

68051 ^{23}Na NMR of Na^- in a disordered material. P.P.Edwards, S.C.Guy, D.M.Holton (Chem. Lab., Univ. of Cambridge, Cambridge, England), W.McFarlane.
Philos. Mag. B (GB), vol.47, no.4, p.367-75 (April 1983).
A negative effective Hubbard correlation energy (negative *U*) in chalcogenide glasses leads to a preponderance of valence-alternation defect pairs, D^+ and D^-, in the energy gap of these disordered materials. The authors show that a dilute solution of sodium in a non-aqueous solvent can also have this property, yielding Na^+ and Na^- as the major diamagnetic ground states. The direct observation of Na^-, an anion of sodium, is accomplished by ^{23}Na NMR spectroscopy. Na^- exists in this system as a genuine 'gas-like' metal anion in which the two valence electrons reside in an unperturbed 3s orbital, and effectively shield the sodium 2p electrons from the influence of the host matrix. (33 refs.)

68052 Magic-angle rotation ^{11}B NMR studies of chemical structure for solid tetrahaloborates. R.K.Harris, A.Root (School of Chem. Sci., Univ. of East Anglia, Norwich, England), K.B.Dillon.
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.309-10 (1983).
It is shown that the technique of magic-angle rotation suffices to narrow ^{11}B NMR lines for solid tetrahaloborates so that peaks due to different ions can be resolved. The method is found to give detailed structural information for a sample containing a mixture of ions of the type $[BCl_nBr_{4-n}]^-$. (18 refs.)

68053 Amplification effects for nuclei in domain boundaries at low temperatures. V.P.Chekmarev (A.F. Ioffe Physicotech. Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1629-30 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2870-2 (Sept. 1982). [received: April 1983]
The author presents the results of analyzing the low-temperature-amplification coefficient properties for nuclei located in domain walls. He considers a 180° domain wall in the simplest case of a ferromagnet with single-axis anisotropy. In this case the NMR frequency for nuclei in the domain walls is $\omega_{n\theta}=\omega_{n0}-\Delta\omega\ \sin^2\theta$, where ω_{n0} is the NMR frequency in a domain, θ is the angle determining the position of an isochromat in the domain wall. (6 refs.)

68054 Resolution of transient NMR experiments in the rotating coordinate system in solids. A.E.Mefyod, E.B.Fel'dman (Inst. of Radio-Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1789-90 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3156-8 (Oct. 1982). [received: April 1983]
The authors consider a technique of direct observation of NMR in the effective field H_{eff} acting in the rotating coordinate system. In this technique the NMR signal is formed at the frequency $\Theta_0=\gamma H_{eff}\ll\omega_0$ and is recorded during the action of the RF field over one passage by measuring the longitudinal component $M_z(t)$ of the nuclear magnetization $M(z\|H_0)$. (6 refs.)

68055 Proton NMR investigations of the smectic-C phases of three alkyloxy-azoxybenzenes. S.Limmer, M.Findeisen (Sektion Phys., Karl-Marx-Univ., Leipzig, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.434-46 (April 1983).
Proton NMR investigations of the smectic-C phases of three 4,4′-bis-*n*-alkyloxy-azoxybenzenes (C_7, C_8, C_9) with temperature independent tilt angles are presented. The behaviour of well-aligned samples (strong magnetic field ≳1.5 T, slow cooling rate) under rotation in the field can be described by the models of Luz and Meiboom (1973), and Wise, Smith, and Doane (1973), (LM/WSD), resp. However, on polarization of the samples in presence of magnetic fields ≲0.75 T the molecular directors are not arranged preferentially parallel to the direction of the polarizing magnetic field but are rather inclined, i.e. the layers are stacked preferentially perpendicular to the original magnetic field direction (PSL model). It is shown that all the angular dependences of NMR second moments can be interpreted in terms of a superposition of the LM/WSD and PSL models, or, on the other hand, by assuming totally disordered fractions of the samples together with portions that fully obey the behaviour demanded by one of the above models (LM/WSD or PSL). The tilt angles derived from the comparison of experimental and theoretical angular dependences of the second moments for well-aligned samples are applied to the explanation of the experiments at lower polarizing fields successfully, too. (20 refs.)

Dynamical averaging of two symmetry-related magnetic resonance tensors in single crystals .... See Entry 64926

Improvement in the cross-polarization NMR experiment for suppression of rigid protonated carbons .... See Entry 64936

Landau-type theory applied to mixtures of liquid crystals of opposite diamagnetic anisotropies .... See Entry 66815

Bond length measurements in amorphous solids by nutation NMR spectroscopy: the role of RF field homogeneity .... See Entry 66834

Boron and hydrogen bonding in B-doped a-Si:H—an NMR study .... See Entry 66846

Alkali fluoride containing ZrF_4-based glasses: electrical properties and NMR investigation .... See Entry 67278

Phase diagram of the antiferromagnet $CsMnCl_3.2H_2O$ near the bicritical point. Effect of impurities .... See Entry 67923

Electronic configuration of copper ions in $Cd_{1-x}Cu_xCr_2Se_4$ ($x\leq0.07$) .... See Entry 68076

Study of the electrochromic effect in vanadium and tungsten oxides .... See Entry 68174

Novel features in the stereochemistry of octacyanides: phase transition in tetra-n-butylammonium octacyanotungstate(V) .... See Entry 68191

76.60C Chemical and Knight shifts

68056 Coordination compounds of $[Hg\{PPh_2[M(CO)_5]\}_2]$, (M=Cr, Mo, W). P.Peringer (Inst. fur Anorg und Analyt. Chemie, Univ. Innsbruck, Innsbruck, Austria).
Polyhedron (GB), vol.1, no.11-12, p.819-20 (1982).
Coordination of various neutral N and O ligands causes drastic changes in $^1J(^{31}P\text{-}^{199}Hg)$ (increase up to the threehold) and $\delta(^{31}P)$ (shifts up to 30 ppm to low frequencies), which are due to the presence of the $M(CO)_5$ groups. The complexes with DMSO, phen and bipy were isolated in the solid state. No coordination of $[Hg\{PCy_2[Cr(CO)_4]\}_2]$ with the above ligands is observed. (5 refs.)

68057 Measurement of ^1H Knight shift and magnetic susceptibility in compressed powder samples of $TaH_{0.61}$. W.Baden, A.Weiss (Inst. fur Phys. Chem., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.459-62 (April 1983).
Measurements of the Knight shift K_H and the magnetic susceptibility of $TaH_{0.61}$ on thin foils, prepared from $TaH_{0.61}$ powder at high pressure, are reported. It is shown that the method leads to useful results and is applicable to brittle materials for which compact samples are not available. Both, K_H and χ_v, are given for the hydrides TaH_x in the range $0\leq x\leq0.74$. (12 refs.)

^{13}C shift anisotropies in polycrystalline calcium formate ....See Entry 66024

Phase transitions in discotic liquid crystals. [NMR observations] ....See Entry 67203

Local binding configuration of phosphorus in doped and compensated amorphous hydrogenated silicon ....See Entry 68075

76.60E Relaxation effects

68058 Intervalence excitations of a mixed-valence salt: NMR and optical absorption in molten $InCl_2$. W.W.Warren,Jr. (Bell Labs. Inc., Murray Hill, NJ, USA), G.Schonherr, F.Hensel.
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.505-8 (15 April 1983).
The authors report ^{115}In nuclear relaxation rates for molten $InCl_2$ and visible-near-infrared absorption spectra for molten $InCl_2$ and In_2Cl_3. A weak band at 2.1 eV in $InCl_2$ is attributed to the intervalence transfer excitation $In^{+} \to In^{3+}$. The intensity of the intervalence band is correlated with the lifetime of the excited, magnetic ion In^{2+} measured by NMR. (6 refs.)

68059 Proton NMR and dielectric relaxations in some phenolic Mannich bases. M.Jeyaraj, J.Sobhanadri (Dept. of Phys., Indian Inst. of Technol., Madras, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.841-3 (Oct. 1982). [received: April 1983]
Spin-lattice relaxation times (T_1) are determined for different protons in 3 phenolic Mannich bases in pure liquid state. Standard 180°-t-90° pulse sequences are employed. NMR rotational correlation times (τ_c) evaluated for different protons are compared with the dielectric relaxation times of the respective molecules. Ring protons seem to significantly contribute to the observed relaxation in these molecules. (12 refs.)

68060 Deuterium relaxation of a partially oriented methyl group. III. Order director fluctuations and solute reorientation in a nematic solution of acetonitrile-d_3. D.Jaffe, R.L.Vold, R.R.Vold (Dept. of Chem., Univ. of California, San Diego, La Jolla, CA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4852-7 (15 April 1983).
For pt.II see J. Mag. Reson., vol.46, no.3, p.496 (1982). Deuteron spin-lattice relaxation rates (R_{1Z}) and relaxation rates of quadrupolar order (R_{1Q}) have been determined between 13 and 47°C at 38.4 MHz, for a 10.5 mol% of acetonitrile-d_3 in Merck Licristal phase 5, and selective and nonselective measurements of spin-lattice relaxation have been carried out at 4.6 and 9.2 MHz over the same temperature range. The data can be satisfactorily explained by a combination of fast, anisotropic reorientation (corrected for effects of static ordering) and hydrodynamic fluctuations in the orientation of the nematic director. Large values of the rotational anisotropy were derived from the spin-lattice relaxation data, and confirmed by 38.4 MHz measurements of the temperature dependence of the relaxation rate $R_2(ZQ)$ of a zero quantum coherence. The results obtained here are discussed in terms of recent related ^{13}C relaxation studies of acetonitrile in nematic solution. (21 refs.)

68061 NMR study of spectral densities over a large frequency range for intermolecular relaxation in liquids: pair correlation effects. J.P.Albrand, M.C.Taieb (Dept. de Recherche Fondamentale, CENG, Grenoble, France), P.H.Fries, E.Belorizky.
J. Chem. Phys. (USA), vol.78, no.9, p.5809-15 (1 May 1983).
In order to study the dynamic effects of pair correlation functions on intermolecular translational relaxation in liquids, the authors have measured the relaxation times T_1 of the protons in neopentane in the presence of di-t-butylnitroxide free radicals with concentrations varying up to 6.5×10^{20} paramagnetic centers$\times cm^{-3}$. Under these conditions, the dominant relaxation mechanism for the resonating protons arises from their interactions with the electronic spins of the free radicals. NMR experiments were performed between 2.2 and 250 MHz and these allowed the authors to obtain information about the behavior of the relevant spectral densities over a very wide range of frequencies $0 < \omega_s \tau \lesssim 50$, where ω_s is the electronic resonance frequency of the radical and where τ is the translational correlation time. It is shown that a model in which the effects of eccentricity of the spins are included and where the translational motion of the molecules is described by a Smoluchowski diffusion equation, (i.e., taking into account their impenetrability and the nonuniform relative distribution of the molecules calculated in the approximation of Lee and Levesque, 1973) gives good agreement with experiment. It is also emphasized that introducing pair correlation effects provides a model without any adjustable parameters which is an advantage compared to a theory of random jumps. (28 refs.)

68062 A ^{1}H NMR study of the effects of Ni additions on the behavior of hydrogen in β-vanadium hydride. S.Hayashi, K.Hayamizu, O.Yamamoto (Nat. Chem. Lab. for Industry, Ibaraki, Japan).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.601-6 (1983).
The behavior of hydrogen in the hydrides of vanadium metal containing small amounts of nickel was studied by ^{1}H NMR spectroscopy. FT spectra and spin-spin and spin-lattice relaxation times for $VH_{0.77}$, $V_{0.95}Ni_{0.05}H_{0.73}$ and $V_{0.90}Ni_{0.10}H_{0.65}$ were measured at temperatures between 77 and 400K. On the addition of nickel the number of hydrogem atoms on O_{z2} sites decreases and the superstructure of hydrogen is altered. Different effects of nickel on hydrogen diffusion are observed above and below about 200K, and therefore the mechanism of hydrogen diffusion is assumed to change at this temperature. (16 refs.)

68063 Molecular motion in solid tetraethylammonium halides. B.Szafranska, Z.Pajak (Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).
J. Mol. Struct. (Netherlands), vol.99, no.1-2, p.147-57 (May 1983).
The second moments of the proton NMR lines as well as spin-lattice relaxation times, T_1, for polycrystalline tetraethylammonium halides $[(C_2H_5)_4]NX$, $X=F^-$, Cl^-, Br^- or I^- were measured from 77 to 473K. A stepwise decrease in the temperature dependences of the second moments and minimum values of the relaxation times have been observed for all the compounds studied. The experimental results are discussed in terms of a theoretical model with consecutive onset of reorientations of the methyl and ethyl groups and cationic tumbling. The appropriate activation parameters have been determined. Reorientations of the ethyl groups around N-C bonds are found to be highly correlated. The motional behaviour appears significantly affected by phase transitions and anion-cation interaction. The occurrence of the solid-solid phase transitions was verified by DTA. (19 refs.)

68064 Nuclear spin-lattice relaxation in a lithium-silicate glass. P.Heitjans, B.Bader, K.Dorr, H.J.Stockmann, G.Kiese, H.Ackermann, P.Freilander, W.Muller-Warmuth (Fachbereich Phys., Univ. Marburg, Marburg, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.143-7 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The spin-lattice relaxation rate T_1^{-1} of ^{8}Li in the silicate glass $(SiO_2)_{0.67}(Li_2O)_{0.33}$ has been measured over the temperature range $6K \leq T \leq 340K$ and the magnetic field range $14\ mT \leq B \leq 830\ mT$ using the asymmetric β-decay radiation of polarized ^{8}Li nuclei. The polarization showed non-exponential decay. T_1^{-1} was found to depend approximately linearly on B^{-1} and T for $T < 170K$. The results can be explained within the framework of a phenomenological model. (14 refs.)

68065 Nuclear magnetic resonance of ^{169}Tm (enhanced) and ^{31}P in $TmPO_4$. B.Bleaney, J.H.T.Pasman, M.R.Wells (Clarendon Lab., Oxford Univ., Oxford, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.75-90 (8 May 1983).
The enhanced nuclear magnetic resonance spectrum of ^{169}Tm ($I={}^1/_2$) in the tetragonal compound $TmPO_4$ has been measured from 1.6K to 30K. It is highly anisotropic, with $\gamma/2\pi = 11.34$ and 276 MHz T^{-1} parallel and perpendicular to the c-axis respectively, at the lowest temperatures. The corresponding values of the Val Vleck electronic susceptibility per ion are 0.0231 and 0.805 $\mu_B\ T^{-1}$. Above 4K the values of $\gamma/2\pi$ become temperature dependent as excited levels become populated, and the results are discussed in the light of a crystal field calculation of the energy levels and wave functions. The NMR spectrum of ^{31}P ($I={}^1/_2$) is shown to exhibit an anisotropic paramagnetic shift, mainly dipolar in origin, exactly proportional to the electronic susceptibility of the Tm^{3+} ions, and this is used to extrapolate the measurement of γ for ^{169}Tm up to 64K in the perpendicular direction. A simple calculation of the direct process for spin-lattice relaxation shows that this is orders of magnitude too slow to account for the observed relaxation rates, which must be ascribed to the presence of paramagnetic impurities. (22 refs.)

68066 The spin-lattice relaxation of the moving two-spin group in multipulse spin locking. Yu.N.Moskvich, A.M.Polyakov, S.P.Prozorov, V.E.Zobov, A.V.Ponomarenko (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K35-8 (1 March 1983).
It is shown that the motion induced spin lattice relaxation time T_{2e} has different magnetic field dependences if the measurements are performed for slow or rapid motions. However the authors have found that this feature is not always observed. They investigate the effect using measurements on stilbite $CaAl_2Si_7O_{18}.7H_2O$. (7 refs.)

68067 Frequency dependence of spin-lattice relaxation of ^{1}H and ^{7}Li nuclei in concentrated nickel solutions. K.Kabal, V.L.Chizhik.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.20-4 (Feb. 1983). In Russian.
Spin-lattice relaxation rates of protons and lithium nuclei in concentrated nickel solutions have been measured. These quantities are shown to depend on the resonance frequency level. The nature of the effect is discussed. (19 refs.)

Proton Zeeman and dipolar relaxation study of the ferroelectric liquid crystal DOBAMBC ....See Entry 66819

^{1}H NMR study of the phase separation and the behavior of hydrogen in $Ti_{1-y}V_yH_x$ ....See Entry 68071

76.60G Quadrupole resonance

68068 On the order-disorder phase transition of anilinium halides. VI. Phase transition in $4\text{-}RC_6H_4NH_3{}^+X^-$, and $C_6N_5HR'H_2{}^+X^-$, $X=Br,I$. A ^{79,81}Br and ^{127}I NQR study. V.G.Krishnan, A.Weiss (Inst. fur Phys. Chem., Tech. Hochschule Darmstadt, Darmstadt, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.254-63 (March 1983).
By ^{79,81}Br and ^{127}I NQR spectroscopy $4\text{-}FC_6H_4NH_3{}^+X^-$, $4\text{-}FC_6H_4ND_3{}^+X^-$, $4\text{-}(H_5C_2)C_6H_4NH_3{}^+X^-$, $C_6H_5N(CH_3)H_2{}^+X^-$, $C_6H_5N(C_2H_5)H_2{}^+X^-$, $X=Br$ and I, respectively, were studied in the temperature range $77 \leq T/K \lesssim 400$. All the para substituted compounds experience a phase transition of higher order (presumably second order), the nature of which is most likely a ferroelastic one as it is in $C_6HY_5NH_3{}^+X^-$, $X=Br$, I. The isotope exchange $H \to D$ lowers the transition temperatures of the parafluoroanilinium halides, the resonance frequencies, the nuclear quadrupole coupling constant of the iodide, but raises the asymmetry parameter of the latter compound. Substitution of a hydrogen atom at the $-NH_2$ group in aniline inhibits the phase transition in $C_6H_5N(CH_3)H_2{}^+I^-$ and $C_6H_5N(C_2H_5)H_2{}^+X^-$, $X=Br$, I. However, a phase transition of first order was observed for $C_6H_5N(CH_3)H_2{}^+Br^-$ at 141.5K. (24 refs.)

68069 Temperature dependence of ^{35}Cl NQR in 2,6-dichloropyridine. S.P.Basavaraju, N.Devaraj (Dept. of Phys., Bangalore Univ., Bangalore, India), A.Indumathy, K.R.Sridharan, J.Ramakrishna.
J. Solid State Chem. (USA), vol.47, no.2, p.236-8 (April 1983).
Chlorine NQR in 2,6-dichloropyridine has been investigated in the temperature range 77K to room temperature and a single resonance line has been observed throughout. Using this data, torsional frequencies of the molecule have been evaluated on the basis of both the Bayer theory (1951) and the modified Bayer theory incorporating the Tatsuzaki correction (1957). (8 refs.)

68070 Temperature dependence of the frequency of pseudoquadrupole resonance of ^{141}Pr nuclei. I.G.Bol'shakov, M.A.Teplov (V.I. Ulyanov-Lenin State Univ., Kazan, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1601-2 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2826-9 (Sept. 1982). [received: April 1983]
The authors show that simple measurements of the temperature dependence of the nuclear resonance frequencies $\nu_{1/2,3/2}$ and $\nu_{3/2,5/2}$ allow one to determine the energy gap Δ separating the ground electronic singlet from the excited states of the Pr^{3+} ion in the crystal electric field. Experiments were carried out with polycrystalline specimens of dielectric praseodymium compounds $Pr_2(SO_4)_3.8H_2O$, $Pr(NO_3)_3.6H_2O$, PrF_3 and $Pr(CH_3COO)_3.2H_2O$. To evaluate the importance of the various contributions to the parameters of the spin Hamiltonian, the authors have made NMR measurements of ^{141}Pr in these substances. (6 refs.)

$VOCl_3$: crystallization, crystal structure, and structural relationships: a joint X-ray and ^{35}Cl-NQR investigation ....See Entry 66959

76.60L Spin echoes

68071 ^{1}H NMR study of the phase separation and the behavior of hydrogen in $Ti_{1-y}V_yH_x$. S.Hayashi, K.Hayamizu, O.Yamamoto (Nat. Chem. Lab. for Industry, Ibaraki, Japan).
J. Chem. Phys. (USA), vol.78, no.8, p.5096-102 (15 April 1983).
The behavior of hydrogen in the Ti-V hydrides was studied by ^{1}H NMR spectroscopy.FT spectra and spin-lattice relaxation times of $Ti_{0.60}V_{0.40}H_{0.90}$, $Ti_{0.40}V_{0.60}H_{0.79}$, and $Ti_{0.20}V_{0.80}H_{0.77}$ were measured in a temperature range between 125 and 425K. A phase separation occurs in the Ti-V hydrides by hydriding, and the β-Ti-V-H and the γ-Ti-H phases are dominant. The former phase increases with temperature, accompanied by the decrease in the latter. The composition in the γ-Ti-H phase is almost independent of tempe-

rature, while it changes with temperature in the β-Ti-V-H phase. In the β-Ti-V-H phase, hydrogen-ordered structures are assumed to be formed, and the hydrogen diffuses faster than in β-VH$_x$ and γ-TiH$_x$. (18 refs.)

68072 Multiphoton NMR spectroscopy on a spin system with $I=1/2$. Y.Zur, M.H.Levitt, S.Vega (Dept. of Isotope Res., Wiezmann Inst. of Sci., Rehovot, Israel).
J. Chem. Phys. (USA), vol.78, no.9, p.5293-310 (1 May 1983).
Multiple quantum effects in double frequency (df) pulsed NMR experiments on multilevel spin systems are studied. In these experiments, the spin systems are irradiated by two RF fields, applied simultaneously. A general theoretical description of these experiments is presented using the theory of Shirley (1965) for time dependent Hamiltonians. Multiphoton resonance conditions are given and time independent fictitious spin-1/2 Hamiltonians are derived using his perturbation theory treatment. With these Hamiltonians, the evolution of the spin systems during df irradiation is approximate. The example of df NMR experiments on an $I=1/2$ spin system is discussed. High order perturbation theory is developed to describe the time evolution of this spin system at a three photon resonance. Accurate computer calculations are performed to examine this time evolution. Df NMR experiments are performed on the single ^{31}P($I=1/2$) transition of phosphoric acid to check the theoretical results. The three photon resonance condition for these measurements is studied as a function of the RF radiation intensities and of the resonance offsets of the two frequency components of df irradiation fields. Special NMR pulse cycles are used to study the dependence of the phase of the coherence created by df pulses on the initial RF phases of the two frequency components. Spin-echo type of experiments are developed to detect the spiral motion of the magnetization vector of the $I=1/2$ spin system at the three-photon resonance. (45 refs.)

68073 NMR of ^{141}Pr in ferromagnetic GdAl$_2$ and NdAl$_2$. J.W.Ross, O.Prakash, M.A.H.McCausland (Schuster Lab., Univ. of Manchester, Manchester, England).
J. Phys. F (GB), vol.13, no.5, p.L95-8 (May 1983).
The hyperfine interaction of praseodymium, as a dilute substitutional impurity in GdAl$_2$ and in NdAl$_2$, has been studied by spin-echo NMR at 1.4K. The electric quadrupole splitting is unresolved in the frequency domain, but has been measured by observing the oscillatory decay of the echo amplitude. From the magnetic dipole splitting the authors deduce, after allowance for extra-ionic contributions, that the Pr^{3+} moments in GdAl$_2$ and NdAl$_2$ are $(2.85\pm0.03)\mu_B$ and $(2.96\pm0.03)\mu_B$, respectively. Theoretical analysis of these results yields effective exchange constants for Pr^{3+}:GdAl$_2$ and for Pr^{3+}:NdAl$_2$ which differ significantly from the values to be expected on the conventional model of indirect lanthanide-lanthanide exchange. (13 refs.)

68074 Pressure and temperature dependence of the hyperfine fields of YFe$_2$, YFe$_3$ and YIG. P.C.Riedi, G.D.Webber (Dept. of Phys., Univ. of St. Andrews, St. Andrews, Scotland).
J. Phys. F (GB), vol.13, no.5, p.1057-69 (May 1983).
The hyperfine field (H_T) of ^{89}Y in YFe$_2$ and YFe$_3$ and of ^{57}Fe in single-crystal and sintered polycrystalline YIG has been measured as a function of pressure to 15 bar at room temperature and for YIG also to 7 kbar at 77K. The value of $(\partial \ln H_T/\partial P)_T$ for YIG at 77K is zero to experimental accuracy but is positive at room temperature due to the pressure dependence of the Neel temperature. Little difference was found between the values for single-crystal and sintered YIG. The values of $(\partial \ln H_T/\partial P)_T$ for ^{89}Y in YFe$_2$ and YFe$_3$ were found to be in general agreement with those to be expected if the Y hyperfine field (HFF) is produced by the polarisation of s like conduction electrons but a small contribution from the d band is probably required to explain the results in detail. The spin-wave stiffness coefficient of YIG was found to be (0.568 ± 0.011) eV Å^2 from an analysis of the temperature dependence of the HFF below 20K. This value is in good agreement with those found less directly by earlier HFF and magnetisation measurements and confirms that there is a large discrepancy with the value found by neutron scattering experiments. The reduced HFF at the two Y sites in YFe$_3$ was found to have the same temperature dependence below 35K ($T^{3/2}$ law) and in this region decreases far more slowly than was predicted from analysis of Mossbauer measurements made up to room temperature. Above 100K the difference in the reduced HFF at the two Y sites in YFe$_3$ appeared to be proportional to $T^{3/2}$ which, in view of the low-temperature result, must arise from a partial cancellation of higher order spin-wave terms. (34 refs.)

68075 Local binding configuration of phosphorus in doped and compensated amorphous hydrogenated silicon. J.A.Reimer (IBM Thomas J.Watson Res. Center, Yorktown Heights, NY, USA), T.M.Duncan.
Phys. Rev. B (USA), vol.27, no.8, p.4895-901 (15 April 1983).
From an analysis of ^{31}P nuclear-magnetic-resonance spectra, the chemical nature and local bonding of phosphorus in samples of amorphous hydrogenated silicon (*a*-Si:H) have been determined. Overlapping spectra of threefold- and fourfold-coordinated phosphorus may be separated on the basis of dipolar couplings are identified on the basis of chemical shifts. At low concentrations of phosphorus, the ratio of threefold- to fourfold-coordinated phosphorus is approximately 4 to 1. The magnitudes of the ^{31}P-^{1}H and ^{1}H-^{1}H dipolar couplings indicate that fourfold-coordinated phosphorus is located at internal hydrogenated surfaces. Finally, the increase of fourfold-coordinated sites in compensated *a*-Si:H suggests the formation of boron-phosphorus complexes. (26 refs.)

68076 Electronic configuration of copper ions in Cd$_{1-x}$Cu$_x$Cr$_2$Se$_4$ ($x\leq0.07$). N.M.Kovtun, V.K.Prokopenko, A.A.Shemyakov, T.G.Aminov, G.G.Shabunina (Physicotech. Inst., Acad. of Sci., Donetsk, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1593-4 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2814-15 (Sept. 1982). [received: April 1983]
Elucidation of the nature of the electromagnetic properties of chalcogenide spinel (1-x)CdCr$_2$Se$_4$-xCuCr$_2$Se$_4$ solid solutions has been complicated by the absence of agreement on the valence state of the copper ions. In order to resolve this problem the authors investigated the NMR spectra of Cd$_{1-x}$Cu$_x$Cr$_2$Se$_4$ at values for which the system remains a single phase, $x\leq0.07$. The NMR method allowed them to obtain more complete data on the valence state of the ions, since the local fields at the nuclei of 3d-metal ions are determined by their electronic configurations. The NMR spectra of Cr^{53}, Cu^{63}, Cu^{65}, Se^{77}, Cd^{111}, and Cd^{113} were obtained at 4.2K by the spin-echo method. (6 refs.)

68077 Quantum statistical theory of a one-pulse echo. L.L.Buishvili, E.B.Volzhan, K.O.Khutsishvili (State Univ., Tbilisi, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1808-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3184-6 (Oct. 1982). [received: April 1983]
In the spin echo method, the nuclear spin system with an inhomogeneous broadening of the magnetic resonance line is excited by one or more RF pulses and echo signals representing the response of the nuclear system to the applied pulses are observed. The authors propose a quantum statistical theory of the one-pulse echo in spin systems with the Suhl-Nakamura interaction. For simplicity, they consider the situation when no dynamic shift of the frequency occurs. (6 refs.)

76.70 MAGNETIC DOUBLE RESONANCES AND CROSS EFFECTS

76.70D Electron-nuclear double resonance (ENDOR)

68078 Optical alignment of the electron-nuclear spin system using pumping radiation with modulated polarization. V.L.Vekua, R.I.Dzhioev, I.A.Merkulov, M.N.Tkachuk, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.505-7 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.83-5 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
It is shown experimentally that an effective field due to the nuclei appears when the polarization of the photoexcited electrons is modulated at a frequency much greater than the NMR frequency in an alternating external magnetic field that is synchronized with the modulation of the electron polarization. (4 refs.)

68079 Effect of weak nuclear-field anisotropy on optical alignment in semiconductors. E.S.Artemova, I.A.Merkulov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.511-13 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.89-91 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
An analysis is given of optical alignment in semiconductors in the case of weak anisotropy of the nuclear field, due to a local departure from the symmetry of the crystal lattice. An analytic expression is obtained for the magnetic depolarization curve for recombinational emission (the Hanle curve). (4 refs.)

68080 Optically detected electron-nuclear double resonance in hydrogenated amorphous silicon. Y.Sano, K.Morigaki, I.Hirabayashi (Inst. for Solid State Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.923-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Optically detected electron-nuclear double resonance (ODENDOR) measurements were carried out at 2K and 9.6 GHz, monitoring total emitted light in hydrogenated amorphous silicon. ODENDOR signals were observed in the RF frequency range of 0.6 MHz-15 MHz for the A centre (trapped hole centre) and dangling bond centre. The spatial distribution of weak hyperfine interaction with ^{29}Si nuclear spins may be responsible for broad ONENDOR lines. (7 refs.)

68081 ENDOR investigation of tellurium donors in silicon. J.R.Niklas, J.M.Spaeth (Univ.-GH-Paderborn, Paderborn, Germany).
Solid State Commun. (USA), vol.46, no.2, p.121-6 (April 1983).
Paramagnetic Te$^+$ donors in silicon form deep level impurities. They were investigated with electron nuclear double resonance (ENDOR). The superhyperfine interaction with 12 shells of ^{29}Si nuclei could be determined and it was confirmed that $S=1/2$. 10% of the unpaired spin density are on the central nucleus, 40% in the 4 nearest Si neighbours along ⟨111⟩, altogether 75% are within the 12 shells (108 nuclei). The SHF structure is very similar to that of S$^+$ in Si investigated earlier by Ludwig (1965). From the ENDOR analysis alone it cannot be decided whether Se$^+$ is interstitial or on a lattice site. The distribution of unpaired spin density over the neighbour shells is discussed for both sites. It seems, however, easier to explain it assuming the interstitial site. (19 refs.)

68082 ENDOR investigation of Ni^{3+} in GaP. Y.Ueda, J.R.Niklas, J.M.Spaeth (Univ.-GH Paderborn, Paderborn, Germany), U.Kaufmann, J.Schneider.
Solid State Commun. (USA), vol.46, no.2, p.127-31 (April 1983).
With ENDOR measurements the ligand hyperfine and quadrupole interactions of Ni^{3+} in GaP with 3 shells of P neighbours and 3 shells of Ga neighbours could be resolved. It was established that the effective spin is 3/2, thus the defect is in the 3d^7 state, which confirms the earlier assignment of the centre as an Ni^{3+} from ESR measurements. From the quadrupole interaction of the nearest Ga neighbours it can be concluded that Ni^{3+} is substitutional for Ga. From ENDOR-induced ESR experiments an upper limit for the u-parameter of the B.S^3 term in the spin Hamiltonian was determined. The unpaired spin density distribution shows a pronounced tetrahedral symmetry along the [111]-directions. (17 refs.)

Electron paramagnetic resonance and ENDOR studies of Cr^{3+}-Al^{3+} pairs in forsterite .... See Entry 68003

76.70F Double nuclear magnetic resonance (DNMR)

68083 Transverse nuclear-spin relaxation in the presence of anticrossing of spin levels. E.S.Artemova, I.A.Merkulov, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.508-10 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.86-8 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
It is shown that for nuclei with anticrossing spin levels, the relaxation time of the spin component parallel to the quadrupole interaction axis is comparable with T$_2$ only in a small range of magnetic fields. This conclusion is confirmed experimentally in zero magnetic fields. (2 refs.)

68084 High-resolution solid-state nuclear magnetic resonance and X-ray structure study of choline chloride, bromide, and iodide. D.Wemmer (Dept. of Chem., Univ. of California, Berkeley, CA, USA), V.Petrouleas, N.Panaglotopoulos, S.E.Filippakis, R.M.Lemmon.
J. Phys. Chem. (USA), vol.87, no.6, p.999-1003 (17 March 1983).
^{13}C and ^{2}H high-resolution solid-state NMR studies of choline chloride and bromide in their radiation-sensitive α phases indicate the onset of reorientational motions at temperatures preceding the transition to their radiation-stable (higher-temperature) β phases. These motions are effectively isotropic both below and above the α-to-β phase transitions. The early onset of the rotational motion and the accompanying drop in the radiation sensitivity strongly suggest that the extreme difference in radiation sensitivity between the α and β phases is principally due to processes affected by the rotational motions and not to crystallographic differences. Choline iodide, which is radiation normal at all temperatures so far studied, shows motions of the two methylene carbons even at room temperature. An X-ray study of the latter compound at ambient temperature indicates $P_{2(1)}/m$ as the possible space

group with appreciable disordering between the symmetric positions related by the reflection plane defined by the O, N, and one of the methyl carbons. (14 refs.)

76.70H Optical double magnetic resonance (ODMR)

68085 Electron-hole recombination in As_2Se_3. B.C.Cavenett, S.P.Depinna, W.E.Lamb (Phys. Dept., Univ. of Hull, Hull, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.974-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors ODMR study shows the presence of two separate mechanisms, triplet and pair recombination, associated with exciton and distant-pair luminescence respectively. The resonances are qualitatively similar to previously reported ODMR signals in a-P and a-As_2S_3, and give the first magnetic resonance comparison of intrinsic defects in a chalcogenide crystal and the related glass. The authors also report the first observation of a strong luminescence peak shift with excitation energy in the glass, in fact, both crystal and glass PL spectra are identical for $E_{ex}>2$ eV. (14 refs.)

68086 Investigation of recombination processes in KCl:Tl crystals by optical detection of EPR. N.G.Romanov, V.A.Vetrov, P.G.Baranov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1706-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3014-19 (Oct. 1982). [received: April 1983]
The method of optical detection of EPR in the range 70-80 GHz was used to study tunneling recombination of electron and hole centers in KCl:Tl crystals. The EPR spectra recorded by monitoring the intensity of tunneling recombination afterglow of KCl:Tl crystals irradiated at 300K displayed EPR signals from Tl^{2+} ions in a regular environment, as well as signals from *F* centers. For the transitions between the various magnetic sublevels of Tl^{2+}, EPR signals of different signs were observed. Theoretical calculations of the magnetic quenching of the afterglow and the EPR signals were carried out. In addition to the Tl^{2+}-F recombination, a recombination of Tl^{2+} with electronic centers of a different kind, apparently $A_F(Tl)$, was shown to occur. (14 refs.)

Optical alignment of the electron-nuclear spin system using pumping radiation with modulated polarization ....See Entry 68078

Effect of weak nuclear-field anisotropy on optical alignment in semiconductors ....See Entry 68079

Transverse nuclear-spin relaxation in the presence of anticrossing of spin levels ....See Entry 68083

76.80 MÖSSBAUER EFFECT; OTHER GAMMA-RAY SPECTROSCOPY

68087 A program to analyze series of Mossbauer spectra. E.Verbiest (Inst. voor Kern- en Stralingsfysica, Leuven, Belgium).
Comput. Phys. Commun. (Netherlands), vol.29, no.2, p.131-54 (April 1983).
The author analyzes a series of Mossbauer spectra by fitting them into a function, describing the physical relations between the Lorentzians and depending on parameters of which some are freely adaptable within given limits, some adaptable within limits but required to be identical for all spectra, and some constant. (1 ref.)

68088 High-resolution TDPAC experiments with fast BaF_2 scintillators. A.Baudry, P.Boyer, P.Vulliet (DRF/Lab. Interactions Hyperfines, CENG, Grenoble, France).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.263-9 (Feb. 1983).
TDPAC experiments on ^{181}Ta in various inorganic materials have been performed by using BaF_2 crystals as fast γ-ray scintillators. The use of such scintillators allows reaching a time resolution as low as 600 ps with both high detection efficiency and good energy resolution. (14 refs.)

68089 Internal magnetic hyperfine fields at Hf nuclei in iron, cobalt and nickel hosts. N.Aggarwal, B.Singh, A.K.Bhati, R.Bala, S.C.Bedi, H.S.Hans (Dept. of Phys., Panjab Univ., Chandigarh, India).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.271-4 (Feb. 1983).
Integral perturbed angular correlation technique has been used to measure the internal hyperfine magnetic fields at Hf nuclei in Fe, Co and Ni matrices. These represent a consistent set of measurements with diffused sources. The $^9/_2{}^+$ (208 keV) $^9/_2{}^-$ (113 keV) $^7/_2{}^-$ cascade in the decay of $^{177}Lu\rightarrow{}^{177}Hf$ was used for measurements. The measurements are compared with previous results and discussed in terms of methods of source preparation. (16 refs.)

68090 Disparity between the transient hyperfine fields for Pt and Os in Fe; an electron vacancy sharing interpretation. A.E.Stuchbery, C.G.Ryan, H.H.Bolotin (Univ. of Melbourne, Parkville, Victoria, Australia).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.275-95 (Feb. 1983).
Precessions of the $2_1{}^+$ states in ^{198}Pt and ^{192}Os have been measured in the enhanced transient hyperfine magnetic field acting on these nuclei as they recoiled through thin polarized cobalt foils. Two separate targets consisting of contiguous layers of ^{198}Pt and ^{192}Os electrodeposited on ~1 μm and ~4 μm Co foils were employed. The levels of interest were Coulomb excited by 80 MeV ^{32}S and 220 MeV ^{58}Ni beams and the precessions of the $2_1{}^+\rightarrow 0_1{}^+$ γ-ray angular distributions in both nuclides were measured simultaneously. The results of these studies are compared with recently reported similar studies in which ions of ^{188}Os and ^{194}Pt recoiled through thin polarized Fe foils. It is concluded that (i) the transient field acting on Pt in Fe is singularly anomalous, and (ii) the recent contention that the g-factors of the $2_1{}^+$ states in the even Pt isotopes may be substantially lower than had been reported in the literature cannot be sustained. This transient field discontinuity is examined in terms of possible molecular orbital electron vacancy sharing between Pt and Fe. (32 refs.)

68091 Temperature dependence of the hyperfine quadrupolar interaction in K_2ZrF_6. J.A.Martinez, A.M.Rodriguez, M.C.Caracoche, R.C.Mercader, A.R.Lopez Garcia, P.C.Rivas (Dept. de Fisica, Univ. Nacional de La Plata, La Plata, Argentina).
Hyperfine Interactions (Netherlands), vol.13, no.4, p.307-13 (Feb. 1983).
The thermal dependence of the hyperfine quadrupole interaction of $Tu^{181}Ta$ at Zr sites in K_2ZnF_6 has been studied by TDPAC between RT and 511°C. Four phases of ever increasing symmetry have been found in the range RT-437°C. The possible existence of a healing mechanism with an activation energy of 0.187±0.040 eV is discussed for the lattice recovery in the range 270°C-335°C. The results at temperatures above 437°C can be understood assuming a thermal decomposition of the compound. (12 refs.)

68092 Analysis of the Mossbauer-effect probability and the Mossbauer-line symmetry for SnO_2. V.A.Varnek, A.P.Chernyshev (Inst. of Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.5, p.700-3 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.835-7 (May 1982). [received: Feb. 1983]
The Mossbauer effect probabilities for SnO_2 were refined using the black absorber method. The mean-square displacements of the tin atom and the Debye temperatures for a broad temperature range were obtained. (14 refs.)

68093 Nuclear-gamma-resonance-spectral analysis of structural transformations of iron-containing chrysotile asbestos and its composition with polyorganosiloxane during heat treatment. S.P.Ekimov, L.M.Krizhanskii, V.A.Krotikov, L.V.Filina, N.P.Kharitonov (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.5, p.724-9 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.864-9 (May 1982). [received: Feb. 1983]
Iron-containing chrysotile asbestos and its composition with a polyorganosiloxane (POS) calcined at various temperatures up to 1300°C were subjected to a study by means of nuclear gamma resonance spectroscopy. The Fe_3O_4 present in the starting asbestos sample undergoes successive conversion to α-Fe_2O_3, the $(Fe_{0.75}Al_{0.25})_2O_3$ mixed oxide, and a spinellide on the basis of $MgFe_2O_4$. Reduction of Fe^{3+}, which is accompanied by replacement of Mg^{2+} by Fe^{2+} in the silicate phases, namely forsterite and enstatite, begins at 1110-1150°C. A mixed oxide is not formed in the presence of added POS, the fraction of the olivine component decreases as compared with the pyroxene component, and the transition of iron from the $(\alpha\text{-}Fe_2O_3)_s$ superparamagnetic phase to α-Fe_2O_3, olivine, and pyroxene takes place to a greater extent. Microparticles of $(\alpha\text{-}Fe_2O_3)_s$ are formed at 700°C primarily from the iron in the asbestos lattice both in the presence and absence of added POS. (14 refs.)

68094 Analysis of asymmetry of the Mossbauer line of tin(II) sulfide and selenide. V.A.Varnek, T.I.Guzhavina (Inst. of Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.5, p.735-7 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.875-6 (May 1982). [received: Feb. 1983]
The Mossbauer spectra of the layered semiconductor compounds SnS and SnSe exhibit asymmetry of components of the quadrupole doublet, which is explained by manifestation of the Gol'danskii-Karyagin effect. The results of the spectral resolution enable the authors to conclude that the observed asymmetry of the Mossbauer spectra of SnS and SnSe is related to the difference of the widths of the components of the quadrupole doublet. Such difference of the widths includes, for example, the correlated variation of the chemical shifts and quadrupole splittings due to the weak nonequivalence of the tin atoms in the crystal-lattice points. The possible reason for such nonequivalence is some difference in the composition in various areas of the crystallites from a rigorously stoichiometric composition. (8 refs.)

68095 Mossbauer spectroscopy on high-spin d^5 iron complexes: crystal field calculations. K.Spartalian, C.J.Carrano (Univ. of Vermont, Burlington, VT, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4811-16 (15 April 1983).
Mossbauer spectra of high-spin ferric Fe(EHPG) compounds in frozen solution have been recorded at 4.2K in a small applied field. The spectra have been analyzed in terms of a spin Hamiltonian with $S=5/2$ used as an intermediate step for generating a crystal field model that has the ground sextet $^6A_1$ and three excited quartet states appropriately spaced in energy. The model has been found to be appropriate for *g*-4.3 high-spin ferric complexes with spin Hamiltonian D values in the range 0.6-1.7 cm^{-1}. It is shown that the model can provide a three-way correlation of the relevant data obtained by Mossbauer, EPR, and optical absorption spectroscopy. (15 refs.)

68096 On the magnetic properties of B_2O_3-PbO-Fe_2O_3-K_2O and B_2O_3-PbO-Fe_2O_3-CaO glasses. E.Burzo, D.Ungur (Nat. Center of Phys., Bucharest, Rumania), I.Ardelean.
J. Phys. (France), vol.44, no.5, p.647-50 (May 1983).
The 20 $Fe_2O_380[3B_2O_3(1\text{-}x)PbOxA_uO_v]$ glasses with $A_uO_v=K_2O$ and CaO were studied by magnetic and Mossbauer effect measurements. The variation of the fraction *r* of ferrous ions is proportional to the difference between the valence of A ions and that of lead as well as to A_uO_v content. The composition dependence of *r* values is analysed in correlation with the glass composition. (9 refs.)

68097 Conversion electron Mossbauer spectroscopy and LEED on epitaxial γ-Fe thin films grown on Cu(100). W.Becker, H.-D.Pfannes, W.Keune (Lab. fur Angewandte Phys., Univ. Duisburg, Duisburg, Germany).
J. Magn. & Magn. Mater. (Netherlands), vol.35, no.1-3, p.53-4 (March 1983). (Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces, Yokohama, Japan, 13-16 Sept. 1982).
FCC (γ-)Fe(100)-films prepared by epitaxial growth in UHV on Cu(100)-films were investigated by conversion electron Mossbauer spectroscopy (CEMS) at 295K using a He-CH_4 flow-gas counter. The FCC structure of the Fe films was confirmed by LEED. The Mossbauer spectra clearly demonstrate that γ-Fe(100)-films are paramagnetic at 295K. Depending on the Fe film thickness part of the Fe atoms exists in the α-Fe phase. (10 refs.)

68098 Fe bonding short range order and magnetism in ternary oxide glasses. J.P.Sanchez, J.M.Friedt (CRN, Strasbourg, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.681-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A summary of applications of Mossbauer spectroscopy to the elucidation of electronic, structural and magnetic properties of amorphous materials is presented. Information about short range order and heterogeneity of the distribution of the magnetic element within the glass host inferred from the hyperfine parameter distributions and from magnetic properties respectively is discussed. (4 refs.)

68099 Study of the ion distribution and magnetic properties of Y-Ca-In-Ge iron garnet. Lin Meimei (Dept. of Engng. Phys., Qinghua Univ., Beijing, China), Li Shi, Li Guodong.
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1159-62 (Nov. 1982). [received: April 1983]
Yttrium-calcium-indium-germanium iron garnet (Y-Ca-In-GeIG) is a kind of microwave-ferrite with a low saturation magnetic moment and narrow ferromagnetic resonance line-width. It is obtained by substituting ions into yttrium iron garnet (YIG), and its magnetic properties are closely related to distribution of its cation in the tetrahedral, octahedral and dodecahedral sites, thus in this respect emphasis has been laid on both basic research and practical application. The authors study the distribution of Fe ions by means of the Mossbauer effect and then discuss the relationship between ion distribution and magnetic properties. (12 refs.)

68100 Localization of electrons in Fe-Co alloys. J.Chojcan, M.Szuszkiewicz, S.Szuszkiewicz, B.Rosenfeld (Inst. of Experimental Phys., Wroclaw Univ., Wroclaw, Poland).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K57-60 (1 March 1983).
The authors have previously determined the electron transfer between the components of the BCC alloys Cr-Fe and V-Fe using angular-correlation data from positron annihilation experiments as well as isomer shift data from Mossbauer effect measurements. In the present paper they have extended investigations to polycrystalline BCC Fe-Co systems. The angular distributions (AD) of the annihilation quanta coming from the two-photon annihilation of an electron-positron pair as well as the transmission Mossbauer spectra (MS) of ^{57}Fe in the alloys $Fe_{1-x}Co_x$ (x=0.1, 0.2, 0.3, 0.4, 0.5, 0.6, and 0.7) were measured at room temperature. (11 refs.)

68101 Mossbauer and X-ray study of $FeP_{0.85}Si_{0.15}$. A.Narayanasamy, L.Haggstrom, T.Sundqvist (Inst. of Phys., Uppsala Univ., Uppsala, Sweden).
Phys. Scr. (Sweden), vol.27, no.3, p.217-19 (March 1983).
Silicon/phosphorus substitution in FeP (MnP-type structure, space group *Pnma*) has been studied by ^{57}Fe Mossbauer spectroscopy. The compound $FeP_{0.15}$ was prepared and the unit cell dimensions were determined to be a=5.2267(3) Å, b=3.0704(3) Å and c=5.8321(4) Å. The ^{57}Fe Mossbauer effect shows that increasing the number of Si neighbours around the iron atoms increases the electric quadrupole splitting and the magnetic hyperfine field, and decreases the center shift. The Neel temperatures is 100K and the magnetic structure is similar to that observed in FeP, with the spins bunched along the crystallographic *a*-direction. (12 refs.)

68102 Magnetism and crystalline electric fields in $R_2Fe_3Si_5$ compounds. D.R.Noakes, G.K.Shenoy, D.Niarchos, A.M.Umarji, A.T.Aldred (Argonne Nat. Lab., Argonne, IL, USA).
Phys. Rev. B (USA), vol.27, no.7, p.4317-24 (1 April 1983).
Results of magnetisation, ^{57}Fe, ^{155}Gd, and ^{166}Er Mossbauer-effect measurements on $Gd_2Fe_3Si_5$ and $Er_2Fe_3Si_5$ are presented. There is no magnetic moment on Fe. The Gd Mossbauer results are used to construct an approximate model of the crystalline-electric-field effects in the heavy rare-earth members of the $R_2Fe_3Si_5$ family. This model predicts large magnetic anisotropy in these materials, explains the well-developed static hyperfine interaction seen in the Er resonance spectra up to 4.2K, and overestimates the deviations from de Gennes-law scaling in the magnetic transition temperature. (16 refs.)

68103 Effect of relaxation on the Mossbauer hyperfine spectra of a Γ_8 quadruplet. O.A.Yakovleva.
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1642-6 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2898-904 (Oct. 1982). [received: April 1983]
The Mossbauer spectra of the hyperfine structure of a Γ_8 quadruplet are studied in a situation when the cubic symmetry of the impurity surroundings breaks down due to fluctuations in the crystal field. It is shown that fluctuations can occur that do not lead to complete averaging of the hyperfine interaction in the limit of fast relaxation. The relaxation hyperfine spectra of a Γ_8 quadruplet are then analogous to the static hyperfine spectra of a Γ_6 doublet. The relaxation spectra of a Γ_8 quadruplet are also studied for magnetic relaxation of a special type which preserves, in the limit of fast relaxation, a part of the quadrupole hyperfine interaction. (6 refs.)

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces ....See Entry 64579

Amorphous to crystalline transformation of $Fe_{81}B_{13.5}Si_{3.5}C_2$ ....See Entry 66853

Distribution of indium ions in indium substituted Mn-Zn ferrites ....See Entry 67028

The lattice dynamics of substitutional tin on the two different lattice sites in III-V compound semiconductors ....See Entry 67126

New phase in SnO_2-P_2O_5 system, [Mossbauer spectra] ....See Entry 67168

Effect of chemical structure on the electron density at the tellurium nucleus ....See Entry 67552

Amorphous barium vanadates doped with transition metals .....See Entry 67610

Investigation of magnetic properties and Mossbauer spectra of $La_xBa_{(1-x)}Fe_{(12-x)}Zn_xO_{19}$ ferrites ....See Entry 67958

Magnetization of ultra-thin epitaxial Fe films ....See Entry 67977

Spectroscopic properties of transition elements in glasses of geological interest ....See Entry 68274

Thermal effect of nitrogen implantation on high carbon steels ....See Entry 68549

About embrittlement process in amorphous metals ....See Entry 68630

76.90 OTHER TOPICS IN MAGNETIC RESONANCES AND RELAXATION

(inc. muon probe studies)

Ferromagnets with random anisotropy: longitudinal spin resonance and movable anisotropy ....See Entry 67916

77.00 DIELECTRIC PROPERTIES AND MATERIALS

(for conductivity phenomena, see 72.20 and 72.80)

77.20 PERMITTIVITY

68104 Dielectric parameters for semiconducting As-Ge-Te and Se-Ge-Te glassy alloys. II. D.R.Goyal, K.N.Lakshminarayan, K.K.Srivastava (Dept. of Phys., Panjab Univ., Chandigarh, India), F.Hufnagel.
Indian J. Pure & Appl. Phys., vol.20, no.12, p.1001-2 (Dec. 1982). [received: April 1983]
Dielectric measurements for some semiconducting As-Ge-Te and Se-Ge-Te glassy alloys are reported. It has been shown, both theoretically and experimentally, that bulk ingots and compressed pellets exhibit similar dielectric behaviour. The theoretical analysis does not provide any evidence of Maxwell-Wagner losses for the suspected inhomogeneities in case of compressed pellets. (10 refs.)

68105 Theoretical results for aqueous electrolytes. Ion-ion potentials of mean force and the solute-dependent dielectric constant. G.N.Patey, S.L.Carnie (Dept. of Chem., Univ. of British Columbia, Vancouver, BC, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.5183-90 (15 April 1983).
The linearized hypernetted-chain theory is applied to solutions of hard spherical ions immersed in a dipole-tetrahedral quadrupole solvent with waterlike parameters. Temperatures ranging from 25 to 300°C are considered and the ion-ion potentials of mean force and the solute-dependent dielectric constant are examined in the infinite dilution limit. For this model electrolyte the ion-ion potentials of mean force are shown to be less structured and to approach the continuum limit more rapidly than those previously obtained for simple dipolar solvents. The limiting slope which determines the behavior of the solute-dependent dielectric constant at low ionic concentrations is negative and much smaller in magnitude than that found for comparable dipolar hard sphere solvents. Finally, the theoretical limiting slope is shown to be consistent with experimental results for aqueous solutions at 25°C and low ionic concentrations. (28 refs.)

68106 The dielectric constant of lamellar semicrystalline polymers. R.H.Boyd (Dept. of Chem. Engng., Univ. of Utah, Salt Lake City, UT, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.505-14 (April 1983).
The problem of representing the dielectric constant of semicrystalline polymers in terms of the dielectric constants and volume fractions of the constituent crystalline and amorphous phases is considered. For locally lamellar morphology, bounds based on uniform electric and displacement fields are derived. The equations also include the degree of crystal orientation as a parameter. For unoriented polymers the bounds are considerably tighter than the Hashin-Shtrikman bounds, the latter being the best possible without knowledge of phase geometries. The bounds presented are sufficiently tight to represent the dielectric constant with practical accuracy for a number of examples of semicrystalline polymers. A treatment is also given of the dielectric constant where the lamellar morphology is further specified as being organised into spherulite-like structures. These bounds are somewhat tighter than the lamellar bounds. (6 refs.)

68107 Dielectric constant of a composite inhomogeneous medium. P.Chylek, V.Srivastava (Nat. Center for Atmospheric Res., Boulder, CO, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5098-106 (15 April 1983).
The authors derive an expression for the effective dielectric constant of a composite medium considering the contributions from both the electric and the magnetic dipole terms. They show that the form of the size distribution of small metallic particles determines the value of the volume fraction at which a sharp increase in AC absorption of a composite material occurs. Depending on the width and mode radius of the size distribution, the effective dielectric constant of a composite medium can be increased by several orders of magnitude. (20 refs.)

68108 Dielectric properties of ammonium fluoroberyllate crystals near phase transitions to an incommensurate phase. B.A.Strukov, V.M.Arutyunova, Y.Uesu (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1732-5 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3061-7 (Oct. 1982). [received: April 1983]
It is shown that in the neighborhood of a commensurate-incommensurate phase transition the permittivity of an ammonium fluoroberyllate crystal is not single-valued, being different for the cooling and heating curves. In a narrow temperature range near the phase transition, the crystal has a two-stage polarization as the electric field increases. It is found that the anomalous hysteresis of the permittivity behaves similarly in the case of $(NH_4)_2BeF_4$ and Rb_2ZnCl_4 crystals. (11 refs.)

68109 Analysis of the unusual position of the low-frequency dispersion region of heterogeneous mixture-spacers system. V.V.Zagoskii, E.A.Zamotrinskaya, T.G.Mikhailnova, V.M.Nesterov (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.590-3 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.14-18 (July 1982). [received: May 1983]
In the paper an analysis is presented of the dependence of the position of the low-frequency dispersion region of a semiconducting heterogeneous specimen-spacers system on the volume concentration of the conducting component, the thickness of the specimen, the thickness (capacity) of the spacers. It is concluded that there exists a surface capacity due to regions of the nonconducting phase of the specimen confined between the spacers and a conducting infinite cluster. (3 refs.)

68110 Spatial dispersion of dielectric permittivity in the theory of solvated electrons and F centers. E.M.Itskovich, A.M.Kuznetsov (Inst. of Electrochem., Acad. of Sci., Moscow, USSR).
Sov. Electrochem. (USA), vol.18, no.7, p.824-30 (July 1982). Translation of: *Elektrokhimiya (USSR)*, vol.18, no.7, p.928-34 (July 1982). [received: March 1983]
Wave functions and energies of the solvated electron and of an electron localized near an ion or defect have been calculated by a direct variational method while allowing for spatial dispersion of dielectric permittivity in the medium. In continuous, homogeneous dielectrics, and radius of localization of the solvated electron increases with increasing correlation length in the medium. In cases where one has electrostatic interaction with an ion or defect or short-range interaction with the nearest surrounding molecules (the cavity model), the behavior of the radius of localization depends on the intensity of this interaction. (3 refs.)

Dynamics of the spectra of solvating systems ....See Entry 65909

The dipole moments of some chloro- and bromopentanes ....See Entry 66155

Dielectric investigations in liquid crystalline substances with elongated lateral groups ....See Entry 66812

The structure and properties of phosphate glasses with transition metals elements ....See Entry 66881

Electric field effect on sound rate in substances with high dielectric constant ....See Entry 67120

Charge carrier escape rate from electrode-liquid interface ....See Entry 67754

A statistical theory for the dielectric properties of thin island films: application and comparison with experimental results ....See Entry 68114

Dielectric relaxation and Freedericksz effect ....See Entry 68116

Molecular relaxation of some rigid polar molecules and their mixtures ....See Entry 68117

Experimental and theoretical approach to molecular dynamics of pyridine derivatives and related molecules from dielectric relaxation measurements. I. 2.3′-bipyridyl in the liquid state ....See Entry 68122

Ferroelectric phase transitions in $CsLiWO_4$ ....See Entry 68135

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

Electronic and ionic polarizabilities in some rutile type crystals .... See Entry 68152

Magneto-optics of cadmium arsenide .... See Entry 68181

Influence of temperature on the effects arising from the spatial dispersion of $CdGa_2S_4$ crystals .... See Entry 68264

77.30 POLARIZATION AND DEPOLARIZATION EFFECTS

68111 **Dynamics of radiation-induced charging and discharging of foil electrets.** B.G.Fallone, E.B.Podgorsak (Dept. of Radiation Oncology, McGill Univ., Montreal, Quebec, Canada).
Phys. Rev. B (USA), vol.27, no.8, p.5062-5 (15 April 1983).
The time dependence of the polarization and depolarization current densities, the effective electric field in the electret chamber, and the electret surface charge densities are presented for the radiation-induced foil electret. With the use of the hyperbolic dependence of the ionization-chamber current density on the effective electric field, one obtains excellent agreement between calculated and measured electret polarization and depolarization current densities. (3 refs.)

68112 **Spontaneous polarization of Langmuir multimolecular films.** L.M.Blinov, N.N.Davydova, V.V.Lazarev, S.G.Yudin (Res. Inst. for Organic Intermediate Products & Dyes, Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1523-5 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2686-91 (Sept. 1982). [received: April 1983]
Three independent experimental methods—measurements of the pyroelectric, piezoelectric, and linear electro-optical effects—are used to demonstrate for the first time the presence of spontaneous polarization in multi-molecular organic films obtained by the Blodgett-Langmuir method. Order-of-magnitude estimates are obtained from the experiment for the pyroelectric coefficients as well as for the parameter $\langle\cos\Theta\rangle$ that determines the deviation from ideal distribution of the molecular dipoles relative to the polar axis of the multilayer (Θ is the angle between the direction of the molecular dipole and the layer axis). (16 refs.)

68113 **Screening of the spontaneous polarization in lead germanate.** V.Ya.Shur, V.V.Letuchev, Yu.A.Popov (A.M. Gorki Ural State Univ., Sverdlovsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1618-19 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2854-6 (Sept. 1982). [received: April 1983]
The authors study the spontaneous polarisation screening in $Pb_5Ge_3O_{11}$. They consider the dynamics of formation of an internal field from a determination of the size of the shift of the dielectric hysteresis loop. (3 refs.)

68114 **A statistical theory for the dielectric properties of thin island films: application and comparison with experimental results.** D.Bedeaux (Inst. for Teoretisk Fysikk, Univ. i Trondheim, Trondheim, Norway), J.Vlieger.
Thin Solid Films (Switzerland), vol.102, no.3, p.265-81 (22 April 1983).
The statistical theory given in ibid., vol.69, p.107 (1980) for the electrical susceptibilities of a thin island film is applied to gold films on a glass substrate. Using the electron micrographs of the films studied experimentally by Norrman et al. (1978), the authors determined the average polarizability of the islands in the direction parallel to the surface. The polarizability density autocorrelation functions were also determined for the films. Using these correlation functions, the optical thickness of the films may be calculated. The agreement of the resulting transmittance with the experimental value was good if the average of the dielectric constants of vacuum and the substrate was used as the inter-island dielectric constant. A theoretical motivation for this choice for metal films is given. It was assumed that the gold islands were, to a good approximation, prolate spheroids. Effects of the image dipoles on the polarizability of the islands as well as on the local field were taken into account. (20 refs.)

68115 **Thermostimulated depolarization currents on a dielectric surface.** C.Huraux, B.Despax (Lab. de Genie Electrique, Univ. Paul Sabatier, Toulouse, France).
Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82), Odense, Denmark, 1982 (Stockholm, Sweden: ASEA 1982), p.7/1-9
Comb-shaped electrodes (obtained from an Al thermal deposit by photoengraving) were used. Surface Thermostimulated Depolarization Current (STDC) spectra were recorded when an insulator was immersed in a gaseous atmosphere (CO_2, He) and compared with STDC spectra recorded on the same specimen in vacuum with the same electrical polarization procedure. New results from glass specimens and a fused silica surface are presented. (2 refs.)

Dielectrophoretic motion of bubbles in liquid .... See Entry 66642

Dielectric properties of ammonium fluoroberyllate crystals near phase transitions to an incommensurate phase .... See Entry 68108

Ferroelectric phase transitions in $CsLiWO_4$ .... See Entry 68135

77.40 DIELECTRIC LOSS AND RELAXATION

68116 **Dielectric relaxation and Freedericksz effect.** H.Kresse (Sektion Chem., Martin-Luther-Univ. Halle, Halle-Wittenberg, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.569-71 (1983).
The author has found that the dielectric anisotropy $\Delta\epsilon'$ of 4-n-butyloxy-4′-n-pentyl-azobenzene is positive at all frequencies. There is in the MHz region a dielectric dispersion for ϵ'_{π} only which gives a decrease of $\Delta\epsilon'$. By means of the Freedericksz effect a new variant was investigated for the dependence of electrical orientation on the frequency. (8 refs.)

68117 **Molecular relaxation of some rigid polar molecules and their mixtures.** M.P.Maden (Dept. of Phys., Univ. of Prince Edward Island, Charlottetown, Prince Edward Island, Canada).
J. Mol. Liq. (Netherlands), vol.25, no.1, p.25-37 (March 1983).
The dielectric behavior of benzene solutions of four rigid polar molecules, benzophenone, benzotrichloride, ortho- and meta-dichlorobenzenes and their mixtures has been studied in the microwave region over a range of temperatures. The dielectric data has been used to determine the relaxation times and the thermodynamic parameters for the activated state. The relaxation times for single component solutions agree well at temperatures at which literature values are available. The relaxation times for mixtures are consistent with those of other rigid molecules studied previously. The results have been also compared with the computed values obtained from a relation proposed by the authors. (30 refs.)

68118 **Relaxation times of bromo-, iodo- & dichloro-benzenes & their binary mixtures at X-band.** B.N.Baruah, B.Baishya (Phys. Dept., Dibrugarh Univ., Assam, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.1003-4 (Dec. 1982). [received: April 1983]
The dielectric absorption data of three simple substituted benzenes, viz. bromobenzene, iodobenzene, *o*-dichlorobenzene, and their binary mixtures in dilute solutions of benzene are measured at 9.82 GHz and at a temperature of 32°C. From the measured data, the dielectric relaxation times (τ) are determined. Further, the free energies of activation (ΔF_{ϵ}) due to dielectric relaxation are calculated for the single compounds and for binary mixtures. The results are explained on the basis of polarity and molecular environment. (8 refs.)

68119 **Dielectric relaxation of some associated liquids in highly viscous media.** M.Gupta, M.Chauhan, S.K.Saxena, J.P.Shukla, M.C.Saxena (Dept. of Phys., Lucknow Univ., Lucknow, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.796-8 (Oct. 1982). [received: April 1983]
Four polar molecules (phenbol and *o*-, *m*- and *p*-cresols) which are of associative nature have been studied for their dielectric behaviour in highly viscous media consisting of varying mixtures of paraffin oil and *n*-heptane. The associative nature of these molecules has been studied in terms of the dielectric relaxation time (τ), and the viscosity of the medium. The dipole moments (μ) of these molecules have also been observed and the nonlinear behaviour of τ and μ has been attributed to the varying amount of aggregation of the solute molecules in various solvents. (17 refs.)

68120 **Relaxation time for binary mixtures of polar liquids.** B.B.Swain (Postgraduate Dept. of Phys., Ravenshaw Coll., Cuttack, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.839-40 (Oct. 1982). [received: April 1983]
The dielectric relaxation times (τ) of mixtures of methyl alcohol with (i) toluene, (ii) chlorobenzene and (iii) n-butanol in different proportions taken in solution in CCl_4, were determined following B.S. Sarma and V.V. Rao's single frequency concentration variation method [Aust. J. Phys. (Australia) 27 (1974) 87]. The values of τ agree with values calculated using Debye's relaxation. The extrapolated value of τ for pure methanol agrees with literature value. (3 refs.)

68121 **Dielectric losses in zinc oxide ceramics.** B.K.Avdeenko, A.S.Tonkoshkur, I.M.Chernenko (Dnepropetrovsk State Univ., Dnepropetrovsk, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.866-9 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1028-31 (June 1982). [received: Feb. 1983]
The effect of the addition of small amounts of Bi_2O_3, Co_3O_4, MnO_2, and Sb_2O_3 on the electrical properties of sintered zinc oxide and ceramics with the composition $aZnO.bBi_2O_3.cCo_3O_4.dMnO_2.eSb_2O_3$ has been investigated. The conductivity of sintered zinc oxide depends significantly on the component added (it changes from 10^2 to 10^{-9} S/cm when 0.5 mole % Bi_2O_3 is added). (8 refs.)

68122 **Experimental and theoretical approach to molecular dynamics of pyridine derivatives and related molecules from dielectric relaxation measurements. I. 2.3′-bipyridyl in the liquid state.** P.Freundlich, E.Jakusek, H.A.Kolodziej, A.Koll, M.Pajdowska (Inst. Chem., Univ. Wroclawski, Wroclaw, Poland), S.Sorriso.
J. Phys. Chem. (USA), vol.87, no.6, p.1034-8 (17 March 1983).
Dielectric relaxation measurements and theoretical calculations were performed on 2,3′-bipyridyl in the liquid state, in the frequency and temperature ranges of 1.8-40 GHz and 293-323K, respectively. A complex dielectric absorption band was found that can be interpreted as being due to the presence of two rotations involving, respectively, the whole molecule and the heterocyclic rings about the C-C central bond. Theoretical calculations of the total interaction energy (as sum of dipole-dipole interaction energy; strain and deformation energies, and the π-electron energy) between the two hexatomic moieties do not exclude the possibility of internal rotation around the C-C bond. Macroscopic dielectric relaxation times were also calculated for both rotations. The activation energy barriers for the two molecular motions were derived. (12 refs.)

Solvent motion controls the rate of intramolecular electron transfer in solution .... See Entry 66121

Proton Zeeman and dipolar relaxation study of the ferroelectric liquid crystal DOBAMBC .... See Entry 66819

The structure and properties of phosphate glasses with transition metals elements .... See Entry 66881

Dipolar reorientation and order-disorder behaviour of pure and mixed alkali cyanides .... See Entry 67193

Proton NMR and dielectric relaxations in some phenolic Mannich bases .... See Entry 68059

Analysis of the unusual position of the low-frequency dispersion region of heterogeneous mixture-spacers system .... See Entry 68109

77.50 DIELECTRIC BREAKDOWN AND SPACE-CHARGE EFFECTS

68123 **Effects of electrode materials on tree initiation in polyethylene under switching surge conditions.** N.Yoshimura, F.Noto (Dept., of Electrical Engng., Akita Univ., Akita, Japan).
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.2, p.120-4 (April 1983).
Four kinds of electrode materials were used. Also, the effects of oxidised Al on the tree initiation was investigated. When a positive switching surge is applied to the needle in a point-to-plane test, little difference is found to exist among the four electrode materials with respect to the stress at the tip of the needle, E_{max} required to produce a tree. When a negative switching surge is applied, it is found that there are large differences of E_{max}. The value of E_{max} increases with the work function of the electrode materials. In addition, with negative polarity, E_{max} increases with the rise time of the impulse wave in a manner which is related to the interaction of work function and space charge effects. It is noted that oxidized Al has a higher E_{max} than non-oxidized Al. When a positive half cycle wave follows a negative half cycle, the value of E_{max} for the positive pulse is reduced from the value for a unipolar positive pulse by an amount which correlates with the work function of the electrode. (8 refs.)

68124 A study of emission lines from electrical trees. C.Laurent, C.Mayoux, S.Noel, N.I.Sinisuka (Lab. de Genie Electrique, Univ. Paul Sabatier, Toulouse, France).
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.2, p.125-30 (April 1983).
A study has been made of the gases appearing in the channels of bush and branch-like electrical trees propagating in low density polyethylene (LDPE) and cross-linked polyethylene (XLPE) subjected to a strong alternating electric field. The emission lines in the spectral range from 300 to 700 nm were observed with a monochromator and a vidicon tube followed by a multichannel analyzer. These lines, characteristic of the gaseous mixture created by the action of discharges on the channel walls, revealed the presence of CO, CO_2, and H_2. The evolution of these lines was followed as a function of time. (16 refs.)

68125 High temperature breakdown characteristics in polyethylene film with fixed electrodes. K.Yahagi, A.Okinaka, S.Katakai (Dept. of Electrical Engng., Waseda Univ., Tokyo, Japan).
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.2, p.138-42 (April 1983).
Electrical breakdown was investigated in films of low-density polyethylene by the application of both pulsed waveform and ramped voltages. Stainless steel ball electrodes and the film to be measured were embedded in a thermoset resin. The breakdown strength F_B increased with temperature T, $\partial F_B/\partial T>O$, between about 80°C and 100°C by application of impulse voltages. This temperature range corresponds to a region of heat absorption in DSC curves. The input energy rate from impulse voltage melts the crystalline lamellae and causes an increases of electrical breakdown strength. (8 refs.)

68126 Decomposition products of silicone liquid due to electric discharge. T.Suzuki, S.Murakami, S.Kobayashi, K.Kiyotaki, M.Umeda (Toshiba Corp., Kawasaki, Japan).
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.2, p.152-7 (April 1983).
Silicone liquid can be used at relatively high temperatures, for instance as an impregnant in transformers for use in trains, because it has high thermal stability and low flammability. The authors describe decompositions of silicone liquid due to electrical discharges, such as arc discharge and partial discharge. It was found that hydrogen, carbon monoxide and cyclic dimethyl siloxane (D_4) are produced due to electrical discharge as in the case of thermal degradation. However, only one kind of dimethyl siloxane (D_4) was found, whereas D_3, D_4, D_5, and D_6 were found in thermal degradation. Moreover, the ratio of the gaseous products to cyclic dimethyl siloxane compounds for partial discharge is much smaller than the same ratio for arc discharge. In both cases the ratio is much larger than the ratio found for thermal degradation. (5 refs.)

68127 Water absorption during water treeing in polyethylene [comment and reply]. W.T.Starr (Raychem., Menlo Park, CA, USA), C.T.Meyer.
IEEE Trans. Electr. Insul. (USA), vol.EL-18, no.2, p.171 (April 1983).
For original paper see ibid., vol.EI.18, no.1, p.28-31 (1933). Comments on the way the numerical analysis has been used to examine the process of water treeing. (1 ref.)

68128 Numerical analysis of steady-state thermal breakdown. M.Hikita, M.Ieda (Dept. of Electrical Engng., Nagoya Univ., Nagoya, Japan), G.Sawa.
J. Appl. Phys. (USA), vol.54, no.4, p.2025-9 (April 1983).
An procedure for numerically solving the fundamental equations of steady-state thermal breakdown has been presented. Assuming an ionic conduction and using the published experimental condition data for poly (ethylene-terephtalate) film, the current-voltage characteristics, the temperature dependence of the critical electric field, and the profiles of temperature and field in the bulk at a constant ambient medium temperature are given. The calculations indicated that moderation of field distortion occurs if a nonlinear field dependence of conduction current is used in place of Ohm's law. The degree of the moderation of field distortion depends on the functional form of the temperature and field dependence of conduction current and the magnitudes of parameters involved therein. Unless these are established and a quantitative evaluation of the thermal breakdown process based on them are made, thermal breakdown cannot be excluded as a possible mechanism for thick samples of polymers. (11 refs.)

68129 The dielectric breakdown properties, current density-voltage and capacitance-voltage characteristics of ion-beam-synthesized Si_3N_4 layers. A.D.Yadav, M.C.Joshi (Dept. of Phys., Univ. of Bombay, Bombay, India).
Thin Solid Films (Switzerland), vol.102, no.3, p.187-99 (22 April 1983).
Si_3N_4 layers were synthesized by 30 keV $^{14}N_2^+$ ion implantation into silicon at room temperature to a total dose of 10^{18} ions cm^{-2}. Studies of the dielectric breakdown strength and the current density-voltage and capacitance-voltage characteristics were carried out on unannealed samples and on samples annealed in various ambients. The dielectric breakdown strength of ion-beam-synthesized Si_4N_4 layers decreases after thermal annealing treatments. The currents through these layers were ohmic for low voltages and space charge limited for higher applied voltages. The electrically dead layer of damaged silicon underlying the ion-beam-synthesized Si_3N_4 dielectric thin film recovers completely to monocrystalline form after vacuum annealing at 900°C for 2.5 hours. (28 refs.)

Nordisk Isolationssymposium. Nord-IS 82 (Nordic Insulation Symposium. Nord-IS 82) .... See Entry 64590

Effect of anodic growth temperature on native oxides of *n*-(Hg, Cd)Te .... See Entry 67826

77.55 DIELECTRIC THIN FILMS

68130 Optical properties and structure of very thin dielectric films. G.M.Mansurov, V.I.Pshenitsyn, Yu.F.Shchetnev, E.V.Kichenko, V.M.Zolotarev.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.844-6 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.142-5 (July 1982). [received: March 1983]
The EM-11N low-voltage electron microscope, and the Perkin-Elmer model 580 spectral instrument with a computer, were used to carry out a systematic investigation of very thin dielectric films. Films of SiO_2 obtained on Ge substrates by different methods: electron-beam evaporation, and molecular deposition were studied. Both types of films revealed nonlinearity in the variation of the absorption as a function of the thickness in the MATR spectra. Electron-microscope photographs showed the island nature of the films. This result agrees with the general physical representations of the nonuniform structure of the surface of a solid. (8 refs.)

Effect of anodic growth temperature on native oxides of *n*-(Hg, Cd)Te .... See Entry 67826

Spontaneous polarization of Langmuir multimolecular films .... See Entry 68112

The dielectric breakdown properties, current density-voltage and capacitance-voltage characteristics of ion-beam-synthesized Si_3N_4 layers .... See Entry 68129

77.60 PIEZOELECTRICITY AND ELECTROSTRICTION

(for piezo-optical effects, see 78.20H)

68131 Free vibrations of a piezoelectric layer of hexagonal (6 mm) class. H.S.Paul, D.P.Raju, T.R.Balakrishnan (Dept. of Math., Indian Inst. of Technol., Madras, India).
Int. J. Eng. Sci. (GB), vol.21, no.6, p.691-704 (1983).
An asymptotic method due to J.D. Achenbach (1969) is used to analyze the free vibrations. In this method, the displacement components, the electric potential and the frequency are expressed as power series of the dimensionless wavenumber $\epsilon=2\pi\times$Layer Thickness/Wavelength. Substituting the expansions of field variables and the frequency in the field equations of piezoelectricity and in the boundary conditions, a system of coupled, second order, inhomogeneous, ordinary differential equations with thickness variable as the independent variable is obtained by collecting the terms of same order ϵ^n. Integration of such systems of differential equations yields the various terms of the series expansions for the field variables and the frequency, for all modes and in the whole range of frequencies, in a range of the dimensionless wavenumber $0<\epsilon<\epsilon^*<1$ where ϵ^* increases as more terms are retained in the expansions. The frequency coefficients reduce to the corresponding ones in the elastic case as a limit. The exact frequency equation in the case of plane strain is obtained and analyzed numerically. (11 refs.)

68132 Electrostriction in the piezoelectric crystals $Bi_{12}GeO_{20}$ and $Bi_{12}SiO_{20}$. K.S.Aleksandrov, V.S.Bondarenko, V.M.Zrazhevskii, M.P.Zaitseva, B.V.Sobolev, Yu.I.Kokorin (L.V. Kirenski Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1806-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3181-4 (Oct. 1982). [received: April 1983]
The authors report a determination of the matrix of electrostriction coefficients R_{mnij} for the piezoelectric crystals $B_{12}GeO_{20}$ and $Bi_{12}SiO_{20}$. To detect the small displacements they have used an electromechanical strain gauge of the capacitive type, having a sensitivity to displacements $\sim10^{-11}$ cm. The gauge was wired into a circuit with an external oscillator. (8 refs.)

Electric field effect on sound rate in substances with high dielectric constant .... See Entry 67120

Influence of a static electric field on the properties of Love surface waves in class 622 and 422 piezoelectric crystals .... See Entry 67332

Strain scattering of electrons in piezoelectric semiconductors . See Entry 67581

Thermoelectric characteristics of anisotropic thermoelements made of elastically deformed *n*-type silicon crystals .... See Entry 67665

Phonon echoes in piezoceramic lead-zirconate titanate .... See Entry 67700

Evolution of the spectrum of a signal during multitransit generation of acoustic waves in piezoelectric semiconductors .... See Entry 67701

Spontaneous polarization of Langmuir multimolecular films ....See Entry 68112

Influence of powder characteristics on the sintering of lead zirconate titanate powders .... See Entry 68488

77.70 PYROELECTRIC AND ELECTROCALORIC EFFECTS

Dynamics of ions of the two-dimensional superionic conductor $AgCrS_2$ .... See Entry 67281

Aysmmetry of the electrical condictivity in pyroelectrics .... See Entry 67617

Spontaneous polarization of Langmuir multimolecular films ....See Entry 68112

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

77.80 FERROELECTRICITY AND ANTIFERROELECTRICITY

68133 Ferroelectromagnets. G.A.Smolenskii, I.E.Chupis (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Usp. (USA), vol.25, no.7, p.475-93 (July 1982). Translation of: *Usp. Fiz. Nauk (USSR)*, vol.137, no.3, p.415-48 (July 1982). [received: April 1983]
The results are presented of the theoretical and experimental studies of ferroelectromagnets—crystals with magnetic and ferroelectric ordering. Considerable attention is paid to reviewing the results of the phenomenological analysis of the influence of the magnetoelectric interaction on the thermodynamic properties of ferroelectromagnets, their reaction to constant and variable electric and magnetic fields, the spectrum of spin waves and ferroelectric oscillations and the methods of exciting them. A table is presented of the expected magnetoelectric effects. The existing experimental studies of magnetoelectric interactions are described and the possible applications of ferroelectromagnets are discussed. A table is given of the known ferroelectromagnetic compounds. (162 refs.)

Features of the behavior of a ferroelectric liquid crystal in alternating fields .... See Entry 66826

A continuum mechanical approach to the ultrasonic relaxation of ferrolectric materials .... See Entry 67121

A model for photovoltaic centres in ferroelectrics .... See Entry 67683

Photovoltaic effect due to scattering by charged point defects in ferroelectrics .... See Entry 67697

The AsO_4^{4-} center in CsH_2AsO_4: a Halperin-Varma defect moving in a single well potential .... See Entry 68018

Impurity effect on the Raman spectra of $Sr_{0.6}Ba_{0.4}Nb_2O_6$ ...... See Entry 68201

77.80B Transitions and Curie point

68134 Direct observation of ferroelectric phase in $Pb_{1-x}Sn_xTe$. K.-P.Mollmann, K.H.Herrmann, R.Enderlein (Dept. of Phys., Humboldt-Univ., Berlin, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.582-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
For the first time a direct proof of ferroelectric behaviour in strongly doped lead tin telluride is given. The structural phase transition from the paraelectric to ferroelectric phase is also seen in the galvanomagnetic and photoelectric properties. An explanation of the observed properties is given by connect-

ing the local Jahn-Teller reconstruction of the lattice around defects with the structural phase transition. (15 refs.)

68135 Ferroelectric phase transitions in $CsLiWO_4$. S.V.Mel'nikova, P.V.Klevtsov, L.I.Zherebtsova, A.I.Kruglik, L.A.Shabanova, V.N.Voronov (L.V. Kirenskii Inst. of Phys., Acad. of Sci., Krasnoyarsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1623-4 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2862-3 (Sept. 1982). [received: April 1983]
The authors study the ferroelectric phase transition in $CsLiWO_4$ by measuring the twinning process in polarized light and the dielectric constant and spontaneous polarization. They made X-ray measurements of the distortions of the cell for polycrystalline samples in the temperature range 80-270K. In addition, they have measured the speed of elastic waves in $CsLiMoO_4$ by a pulsed-ultrasound method in the cubic phase. (3 refs.)

68136 Effect of defects on the ferroelectric phase transitions in crystals of the proustite family. N.D.Gavrilova, V.K.Novik, T.V.Popova (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1735-8 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3068-73 (Oct. 1982). [received: April 1983]
A study is made of the effect of external factors (illumination, electric field, mechanical stress) and defects (vacancies, radiation defects, the thickness of the crystals, the level of uncontrolled impurities in the original materials) on the phase transitions in proustite crystals at 28K, involving a change of symmetry $3m \rightarrow 1$. A photograph of the dielectric hysteresis loop of proustite is obtained for the first time and confirms the symmetry of the ferroelectric phase. Curves of the temperature dependence of the dielectric constant, pyroelectric coefficient, and resistivity of pyrargyrite are measured; the curves indicate that there is a first-order phase transition in this crystal at 4.8K. The possible changes of symmetry at this transition are discussed. (15 refs.)

Pressure dependence of elastic constants of orthorhombic $Li_2Ge_7O_{15}$ above and below the ferroelectric transition ....See Entry 67093

Ab initio determination of static, dynamic and dielectric properties of semiconductors .... See Entry 67125

Heat capacity anomalies at the commensurate-incommensurate-normal phase transitions in K_2SeO_4-type crystals ....See Entry 67233

EPR of Mn^{2+} in the *N*, *R*, and *Q* phases of sodium niobate .. See Entry 68005

Dielectric properties of ammonium fluoroberyllate crystals near phase transitions to an incommensurate phase .... See Entry 68108

Domains in crystals of the barium-strontium niobate type ...... See Entry 68137

Birefringence study of a phase transition in TGS crystals .... See Entry 68169

Raman scattering spectra of K_2ZnCl_4 ....See Entry 68239

Brillouin scattering investigation of paraelectric KH_2PO_4 near the tricritical point ....See Entry 68248

Preparation of strontium tellurite single crystals .... See Entry 68425

A study on the fabrication and the lanthanum dependence characteristics of (Pb, La) (Zr, Ti) O_3 ceramics ....See Entry 68482

77.80D Domain structure and effects; hysteresis

68137 Domains in crystals of the barium-strontium niobate type. M.F.Dubovik, O.D.Kolotii, G.V.Maisov, B.P.Nazarenko (All-Union Sci. Res. Inst. of Single Crystals, Scintillation Materials & Ultrapure Chem. Substances, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.848-52 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1008-12 (June 1982). [received: Feb. 1983]
The formation of a real domain structure in crystals of complex niobates, which in most cases are disordered solid solutions, depends on the degree of stoichiometry of the composition and the structural defects. Therefore, in order to obtain high-quality single crystals of complex niobates of the BSN type, it is necessary to carefully observe the thermal conditions, which determine the formation of such defects as screw dislocations with a Burgers vector parallel to the polar axis, where the microdomains are preferentially formed. (15 refs.)

68138 Ferroelectric domains of a new type: closed loop domains at twinning boundaries. L.I.Dontsova, N.A.Tikhomirova, S.A.Pikin, L.A.Shuvalov (Inst. of Crystallography, Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.223-6 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.181-4 (20 Sept. 1982). [received: April 1983]
The ferroelectric crystal guanidine alumosulfate hexahydrate, $[C(NH_2)_3].[Al(H_2O)_6][SO_4]_2$ (GASH), is known to belong to the class $3m(C_{3v})$ over its entire range of existence and to lack a paraelectric phase. It decomposes when it reaches the Curie point [see, for example, F. Jona and G. Shirane, Ferroelectric Crystals, Pergamon, New York, 1962 (Russ. transl. Mir, Moscow, 1965)]. The 180° GASH domains are optically indistinguishable. The domain structure has accordingly been studied by a decoration method [B. Hilczer et al., Phys. Status Solidi a28, k101 (1975), and F. Suda et al., J. Phys. Soc. Jpn. 45, 916 (1978)] and by an electroluminescence method {I.S. Zheludev et al., Kristallografiya 7, 147 (1962) [Sov. Phys. Crystallogr. vol. 7, 121 (1962)]}. (7 refs.)

68139 Equilibrium domain shape in internally stressed uniaxial ferroelectric crystals. V.V.Gene, V.I.Shul'ga (M.I. Arsenichev Dneprodzerzhinsk Industrial Inst., USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.600-3 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.25-8 (July 1982). [received: May 1983]
The domain shape in pure intrinsic uniaxial ferroelectrics is altered by the application of an electric field perpendicular to P_s, or by mechanical stress. (7 refs.)

Surface twist disclination in nematics on ferroelectric TGS .....See Entry 66814

Inner differentiation of growth sectors induced by the interaction between dislocations and sector boundaries in KH_2PO_4 crystals ....See Entry 67030

Screening of the spontaneous polarization in lead germanate .. See Entry 68113

Effect of defects on the ferroelectric phase transitions in crystals of the proustite family .... See Entry 68136

77.85 ELECTRICAL RESONANCES

Paramagnetic and electric geometric resonances in antiferromagnetic semiconductors .... See Entry 68038

78.00 OPTICAL PROPERTIES AND CONDENSED MATTER SPECTROSCOPY AND OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

(for phonon spectra, see 63.)

78.20 OPTICAL PROPERTIES AND MATERIALS

(see also 81.40T Optical properties related to materials treatment; for masers, and lasers see 42.52 and 42.55 respectively)

68140 Photochromic effect in alkali halide crystals doped with NO_3^- ions. L.M.Belokrinitskaya, L.I.Berezhinskii, I.N.Khalimonova.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.846-9 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.145-9 (July 1982). [received: March 1983]
The investigations were carried out on KI, KBr, and KCl crystals with NO_3^- ions grown in a platinum crucible in air by the Czochralski method with heating of the melt by high-frequency currents. The specimens were irradiated at room temperature with a DRSh-250 lamp through a UFS-1 filter. The thickness of the specimens was chosen in relation to the intensity of the investigated absorption bands and the concentration of NO_3^- ions and ranged from several tenths of a millimeter to several millimeters. (8 refs.)

68141 Optical properties of small metal spheres: surface effects. P.Apell (Phys. Dept., Univ. of Pennsylvania, Philadelphia, PA, USA), D.R.Penn.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1316-19 (25 April 1983).
It has been assumed that the optical properties of small spheres can be understood by means of a Drude dielectric function that incorporates a boundary scattering rate $1/\tau_s \simeq v_F/R$, where v_F is the fermi velocity and R is the sphere radius. An effective scattering rate $1/\tau_s = f v_F/R$ is calculated and f is evaluated as a function of photon frequency. The largest contribution to f is due to the electron density profile of the sphere rather than the boundary scattering that is reduced an order of magnitude by electron screening. (20 refs.)

68142 Preservation of optical selection rules in an amorphous semiconductor. M.H.Brodsky (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), D.P.DiVincenzo.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.971-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
In amorphous solids, distinguishable region of order exist that can be modeled by regular polytopes in curved (non-euclidean) spaces. Selection rules govern hypothetical physical processes, e.g., optical absorption, in such high symmetry non-euclidean structures. The authors show an analogy between curved space azimuthal angular momentum m and crystal momentum k. The selection rule $\Delta m=0$ corresponds to a vertical $\Delta k=0$ transition in a crystal. In amorphous Si, a remnant of the crystalline k selection rule exists near the 1.1 eV absorption edge. (10 refs.)

Reversed photon echo in ruby ....See Entry 66351

Self-induced transparency with the participation of excitons and biexcitons in semiconductors ....See Entry 66353

Bond ordering in noncrystalline solids ....See Entry 66842

Drift of excitons in nonuniformly illuminated crystals .... See Entry 67477

Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$ ....See Entry 68433

78.20B General theory (for pure homogeneous materials)

68143 Anisotropy of nonlinear absorption of light by free carriers in *n*-type germanium. V.L.Malevich (Inst. of Electronics, Acad. of Sci., Minsk, Belorussian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1313-14 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2035-7 (Nov. 1982). [received: April 1983]
Reports a calculation of the nonlinear absorption of light by free electrons in n-type germanium, taking account of the many-valley form of the electron spectrum and the anisotropy of electron-phonon scattering. The case considered is that in which the photon energy is much greater than the mean electron energy, and the carrier energy and momentum scattering is mainly by acoustic phonons. The electron gas in the semiconductor is assumed not be degenerate. (9 refs.)

The origin of the Urbach tail. A Monte-Carlo study of the exciton absorption lineshape ....See Entry 67470

78.20D Optical constants and parameters

68144 Nonlinear regression analysis for the Sellmeier dispersion equation of CdS. B.J.Pernick (Res. & Dev. Center, Grumman Aerospace Corp., Bethpage, NY, USA).
Appl. Opt. (USA), vol.22, no.8, p.1133-4 (15 April 1983).
The wavelength dependence of the index of refraction of transparent solids is best represented by Sellmeier's equation $n^2=A+B/(\lambda^2-C)$, where n is the refractive index and λ the wavelength. The constant C has physical significance as the square of the absorption edge wavelength associated with the material's band gap, where $\lambda^2>C$. In practice, the constants A, B, and C are to be evaluated from experimental data. In cases where a priori knowledge of the value of C is not in hand, a linear least-squares method to determine the constants fails. Other formulas relating refractive index and wavelength are essentially empirical relations convenient for linear least-squares analysis and are interpreted as series expansions of the above expression. Consequently, the author presents a nonlinear regression analysis pertaining to the specific functional form of Sellmeier's equation. (7 refs.)

68145 Thermal change of the refractive index of a linear absorber by an intensive light wave. D.Senderakova, P.Vojtek (MFFUK, Bratislava, Czechoslovakia).
Acta Phys. Slovaca (Czechoslovakia), vol.33, no.2, p.105-14 (1983).
The paper deals with the possibility of studying thermally induced refractive index changes, which arise when an intensive light wave passes through the index, by the method of phase-modulation of a probe light pulse. The method described here does not depend on the mechanism of inducing refractive index

changes. Thermal perturbations of the refractive index of an absorbing medium, which had been induced by a Q-switch ruby laser pulse, were studied experimentally. In the course of experiments both water solutions of $CuSO_4.5H_2O$ and ethanol solutions of a brilliant green were used. (6 refs.)

68146 Cermets of Cu-PbI_2 thin layers: fabrication and determination of optical constants. J.-M.Theriault, G.Boivin (Dept. de Phys., Univ. Laval, Quebec, Canada).
Can. J. Phys. (Canada), vol.61, no.4, p.612-16 (April 1983).
The authors describe a method of fabrication of metal-dielectric mixtures (cermets) deposited by vacuum evaporation. The study is mainly concerned with co-evaporated mixtures of copper and lead iodide. The stabilization of the evaporation rate of copper and lead iodide enables the authors to obtain a homogeneous mixture of these two materials whose mass concentration C is determined from a previous calibration. Photometric measurements carried out on these films lead to the determination of the optical constants N (the index of refraction) and K (the coefficient of absorption). They present the results obtained for mixtures of low concentration in copper. These results are compared with those obtained from the Maxwell-Garnett theory. (23 refs.)

68147 Optical constants and thermal radiative properties of CO_2 cryodeposit. S.Tsujimoto (Dept. of Mech. Engng., Kyoto Univ., Kyoto, Japan), A.Konishi, N.Terada, T.Kunimoto.
Cryogenics (GB), vol.23, no.5, p.251-7 (May 1983).
The optical constants of CO_2 cryodeposit were measured in the wavelength range from 2.5 μm to 21.4 μm below 90K. The peak assigned to the Q branch of ν_3 which grew largely at lower temperatures was found and was considered to show that the linearity of the molecule was broken due to the increase in lattice imperfections. The data of the real part of the complex refractive index at 4000 cm^{-1} were applied to obtain the density of CO_2 cryodeposit as a function of temperature. The result showed that the number of voids and lattice imperfections increases at lower deposition temperatures. The measured optical constants were analysed by dispersion equations to be used for the calculation of the optical properties and thermal radiative properties of surfaces with CO_2 cryodeposit. (26 refs.)

68148 Optical characteristics of Ni-Cr alloys in the solid and liquid states. K.M.Shvarev, N.I.Vnukovskii, B.A.Baum, P.V.Gel'd (Ural Polytech. Inst., Sverdlovsk, USSR).
High Temp. (USA), vol.20, no.4, p.540-4 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.653-7 (July-Aug. 1982). [received: April 1983]
The parameters of the complex index of refraction of Ni-Cr alloys with 0-50 at.% chromium are investigated by polarimetry over the wavelength range 0.37-2.65 μm. The electronic characteristics of the alloys investigated in the IR region are evaluated, including the plasma frequencies and relaxation frequencies of the s-like and hybridized s-d electrons. A correlation is established between the optical properties and the electrical conductivity of the alloys. The emissive characteristics of Ni-Cr alloys in the normal direction at 1600°C are calculated. (16 refs.)

68149 Temperature dependence of residual light transmission in lithium niobate single crystals. N.M.Bezdetnyi, A.I.Bezhanova, M.F.Dubovnik, E.A.Drogaitsev, V.G.Sil'vestrov (All-Union Sci.-Res. Inst. of Single Crystals, S.M. Kirov Azerbaidzhan State Univ., Azerbaidzhan SSR).
Inorg. Mater. (USA), vol.18, no.7, p.1011-13 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1199-201 (July 1982). [received: Feb. 1983]
The temperature dependence of residual light transmission (RLT) is characterized by a certain periodicity and the RLT is minimum ($\sim$1% cm^{-1}) at 263-293K and rises by 3-5 times at 213-333K. Upon heating of the specimens in hydrogen their electrical conductivity rises by more than two orders, the RLT variation range diminishes 2-3 times, and the temperature range of RLT stability widens from 223 to 333K. (5 refs.)

68150 Dispersion of the refractive index of InP and ZnTe. B.Jensen, A.Torabi (Dept. of Phys., Boston Univ., Boston, MA, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2030-5 (April 1983).
An analytical expression for the real part of the refractive index n near the fundamental absorption edge is given in terms of experimentally known quantities for a given semiconductor. It is derived from a quantum mechanical calculation of the complex dielectric constant which assumes the band structure of the Kane theory. The expression obtained is a function of the bandgap energy, the effective electron and heavy hole masses at the band edge, the spin orbit splitting energy, the carrier concentration for n- or p-type materials, the temperature, and the frequency of the incident radiation. Also involved is the value of n at the fundamental absorption edge, which is not accessible to measurement. However, an equation for n at the absorption edge can be found in terms of experimentally obtainable values of n near the absorption edge and solved to give the desired quantity. The refractive index can then be predicted to a high degree of accuracy over the entire frequency spectrum up to the band edge. In particular, the dispersion near the fundamental absorption edge which has been observed experimentally for a number of III-V and II-VI compounds is predicted and its precise calculation enabled. Within limits of the above statement regarding n at the absorption edge, there are no adjustable parameters involved. This constitutes a significant improvement over previous theories of the refractive index of a semiconductor, which typically involve several adjustable parameters. Theory is compared with available experimental results for InP and ZnTe. A method of determining the heavy hole effective mass from measurement of n in compounds where it is unknown is discussed. (27 refs.)

68151 Measurement of the indices of refraction and the absorption coefficients of dielectric materials in the millimeter wave region. B.H.Ahn (USAERADCOM Night Vision & Electro-Optics Lab., Fort Belvoir, VA, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2123-4 (April 1983).
The indices of refraction and absorption coefficients of $LiNbO_3$, $LiTaO_3$, GaAs, and Stycast HiK, a plastic dielectric material, which are used frequently for millimeter wave device fabrication, were measured at 55 and 112.5 GHz using a Fabry-Perot transmission technique in waveguide. (17 refs.)

68152 Electronic and ionic polarizabilities in some rutile type crystals. E.Iguchi, H.Sawatari, H.Satoh (Dept. of Metall. Engng., Yokohama Nat. Univ., Yokohama, Japan).
J. Solid State Chem. (USA), vol.47, no.2, p.239-41 (April 1983).
It has been proposed that certain transition metal oxides with a high dielectric constant as well as large refractive indices such as TiO_2 (rutile), WO_3, and H-Nb_2O_5 use crystallographic shear planes to accommodate nonstoichiometry. In view of the correlation between a high dielectric constant and crystallographic shear planes, the relaxation due to polarisabilities seems to be one of the factors which predisposes such material to this type of stoichiometric change. To reveal this correlation in greater depth, the authors have calculated the electronic and ionic polarisabilities of rutile, because more reliable experimental data are available for this crystal, compared to WO_3 and H-Nb_2O_5. (18 refs.)

68153 Hyperfrequency (35×10^9 Hz) study of the complex permittivity of SiO_2-xNa_2O binaries. A.Dravet, M.Alyari, D.Bourret, R.Sempere, A.Bandhyopadhay, J.Regnier, J.Zarzycki.
J. Phys. Colloq. (France), vol.43, no.C-9, p.115-18 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The interferometric technique was used at 35×10^9 Hertz (Q-band) to investigate the complex permittivity of SiO_2-xNa_2O glasses, with regard to their hydration. Each minimum of the interference fringes has been described by thirty one points. A microvoltmeter driven by a computer allowed a rapid measurement. The glasses have been prepared by two methods: direct melting from silica powder and sodium carbonate, and the bubbling of water vapor and nitrogen in the melt of these compounds. Three compositions: $74SiO_2$-$26Na_2O$; $66SiO_2$-$33Na_2O$ and $55SiO_2$-$45Na_2O$ have been explored with temperature from 20 to 500°C. Variations of ϵ' and ϵ'' are influenced by the Na_2O concentration and the type of preparation of the glasses. Differents quantities of water have been determined by deconvolution of the 2800 cm^{-1} and 3600 cm^{-1} infrared bands. (7 refs.)

68154 Optical and other physical properties of $Al(PO_3)_3$-containing fluorophosphate glasses. J.Yasi, J.Fusong, G.Fuxi (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).
J. Phys. Colloq. (France), vol.43, no.C-9, p.315-18 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The optical and some other physical properties of fluorophosphate glasses in binary systems containing $Al(PO_3)_3$ and the influence of various fluorides on the properties of glass with low $Al(PO_3)_3$ content have been studied. The positions of low $Al(PO_3)_3$ content glasses in $n_d\sim\nu$ diagram have been plotted and the partial properties of fluorides in glass have been calculated. (3 refs.)

68155 Absorption of picosecond light pulses by CdTe single crystals. R.Baltrameyunas, Yu.Vaitkus, M.Pyatrauskas.
Opt. & Spectrosc. (USA), vol.53, no.3, p.341-2 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.575-6 (Sept. 1982). [received: May 1983]
Reports a study of the nonlinear absorption of ultrashort light pulses by n- and p-type CdTe single crystals. The authors have identified some distinctive features in this interaction. (8 refs.)

68156 The optical constants of phases in cast aluminium alloys. I.Aydin (Deloro Stellite GmbH, Koblenz, Germany), H.-E.Buhler.
Prakt. Metallogr. (Germany), vol.20, no.3, p.105-17 (March 1983). In English, German.
The optical properties of aluminium and aluminium compounds were investigated using interference film metallography. Most of the compounds belong to the group of highest reflectivity phases, in which a very good brightness contrast can only be attained with high refractive and absorbing sputter coatings. The optical constants (refractive index and absorption coefficient) were determined for a series of aluminium solid solutions and compounds. (14 refs.)

68157 Auger recombination and non-linear refraction in cadmium-mercury telluride at 10.6 μm. J.R.Hill, G.Parry, A.Miller (Royal Signals & Radar Establ., Malvern, England).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.410-12 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Measurement of power dependence of the far field width of an incident beam of 10.6 μm radiation, with a Gaussian profile, after passage through a polished crystal of $Cd_{0.21}Hg_{0.79}Te$ at 175K has led to the observation of a non-linear refractive index change. The magnitude of the change was found to be $\Delta n=-(7.0\pm3.5)\ 10^{-3}\ I^{1/3}$ where I is the incident intensity in W/cm^2. The $I^{1/3}$ dependence is explained by the predominant role of Auger recombination in limiting the saturation of band edge resonant adsorption. The position of optical components prior to the sample is also considered and is shown to be of fundamental importance in the interpretation of the results. (7 refs.)

68158 Optical reflectivity and band structure of black phosphorus. H.Asahina (Dept. of Phys., Tohoku Univ., Sendai, Japan), Y.Maruyama, A.Morita.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.419-21 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The optical reflectivity measurement was performed on a cleaved surface of black phosphorus single crystal at room temperature for linearly polarized monochromatic light in the range from 0.7 to 3.0 eV. The theoretical reflectivity spectra to be compared with the observed ones were calculated using the band structure obtained by the self-consistent pseudopotential method. The theoretical spectra are in good agreement with the observed ones in shape, magnitude, and polarization-dependence. (8 refs.)

68159 Optical transitions in oriented polyacetylene. D.Baeriswyl, G.Harbeke, H.Kiess, E.Meier, W.Meyer (Labs. RCA Ltd., Zurich, Switzerland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.617-19 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Calculations of the conductivity tensor for π-band transitions give new results on the anisotropy of the dielectric function. The intrinsic optical absorption coefficient for linear polarization has been measured on thin films consisting of highly aligned fibers and was found to be in qualitative agreement with the theory. (13 refs.)

68160 Photoabsorption in amorphous semiconductors using a wave guided CO_2 laser. E.Zeldov, K.Weiser (Dept. Electrical Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.983-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A low energy probe beam ($h\nu\sim$0.1 eV) was used in a wave-guided configuration for photoabsorption (PA) experiments on a-As_2Se_3 using intense pulsed excitation. The results suggest saturation of bandtails and give information about densities of states and the recombination constant. (12 refs.)

68161 The effect of charged additives on the mobility gap and thermal activation energy of $As_2Se_3Cu_x$. Y.Sawan, M.El-Gabaly, N.Kollias (Kuwait Univ., Kuwait).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.995-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Presents and discusses the experimental results of the changes in the optical gap, (mobility gap), and the shape of the optical absorption edge, which were determined at room temperature, using the photoacoustic technique on powdered samples as well as changes in the thermal activation energy, E_{th}, for

glassy alloys $As_2Se_3Cu_x$ ($0 \leq X \leq 1$). It is shown that as X increases from 0 to 1, E_g (at room temp.) and E_{th} decrease from 1.82 eV to 1.30 eV and from 0.92 eV to 0.36 eV, respectively. In all samples ($E_c - E_f$) was found to be nearly constant (1.13 ± 0.02 eV), which indicates a gradual shift of E_v towards E_f by increasing Cu in alloys (max. shift=0.52 eV for X=1). Furthermore, the slope of the exponential tail of the absorption edge was found to decrease and its width to increase by increasing Cu. So far, this behaviour is not reported experimentally for any of chalcogenide materials. A model which takes into consideration ESCA analysis results is presented. (12 refs.)

68162 Time-resolved optical measurement of Si lattice temperature during nanosecond pulsed laser annealing. K.Murakami, H.Itoh, K.Takita, K.Masuda (Inst. of Materials Sci., Univ. of Tsukuba, Ibaraki, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1024-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Time-resolved Si-lattice temperature during pulsed laser annealing has been measured by an interference method, namely a time-resolved optical reflectivity measurement of Si on sapphire (SOS). The time-resolved lattice temperature can be determined from the time-dependent interference variation induced by small changes in the refractive index due to variations of the lattice temperature during pulsed laser annealing. It is found that the Si-lattice temperature for 2.0-μm and 0.6-μm SOS increases to at least 1040K and 1220K, respectively. The maximum temperatures obtained are independent of the substrate temperatures between ~25 and 300K. (10 refs.)

68163 Optical absorption from polarons in a model of polyacetylene. K.Fesser, A.R.Bishop, D.K.Campbell (Center for Nonlinear Studies, Los Alamos Nat. Lab., Los Alamos, NM, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4804-25 (15 April 1983).
The authors present a theoretical calculation, within a continuum electron-phonon-coupled model, of the optical absorption due to polarons in polyacetylene $[(CH)_x]$. The results can be applied to both trans- and cis-$(CH)_x$, as well as potentially to other polymers (polypyroles, polyparaphenylenes) in which polarons are present. They establish that the essential signature of polaron absorption is the existence of three separate absorption peaks in the gap with qualitatively different features. For trans-$(CH)_x$, they compare and contrast this structure with that from the kink solitons, which are expected to dominate the optical absorption at all but the lowest doping levels. For cis-$(CH)_x$ and related polymers, they discuss polaron (and multipolaron) absorption and the relation of polarons to possible excitons in these materials. Finally, they evaluate briefly the existing experimental situation regarding optical absorption in polyacetylene and indicate possible future experiments that could confirm the existence of polarons in $(CH)_x$ and similar polymers. (45 refs.)

68164 Optical response of Cermet composite films in the microstructural transition region. U.J.Gibson, R.A.Buhrman (School of Appl. & Engng. Phys., Cornell Univ., Cornell Univ., Ithaca, NY, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5046-51 (15 April 1983).
Measurements of the intrinsic optical constants *n* and *k* have been made on Au-Al_2O_3 Cermet thin films with metal-fill fractions above and below the percolation threshold. The simple Maxwell-Garnett effective-medium theory, which is successful at low-metal-file fractions, is shown to be inadequate in the description of the system near this threshold, where the microstructure of the composite undergoes a radical change. A modified effective-medium theory, based on a probabilistic growth model recently introduced by Sheng [Phys. Rev. Lett. 45, 60 (1980)] is found to predict the optical response in the transition region with few adjustable parameters. (10 refs.)

68165 Current state of a semiconductor in the field of a strong electromagnetic wave. Ya.G.Girshberg, N.N.Trunov (A.I. Gertsen Pedagogical Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1646-50 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2905-11 (Oct. 1982). [received: April 1983]
It is shown that the absorption coefficient of a semiconductor with an interband electron-phonon coupling in a strong saturating field increases with increasing field and remains finite in the absence of recombination. The special features of the anomalous photogalvanic effect in a strong field, which occur in the ordered phase of a ferroelectric crystal, are studied. (8 refs.)

68166 Optical permittivity of a covalent crystal. V.Ya.Al'tshul', V.K.Bazhenov, A.G.Petukhov (I.I. Mechnikov State Univ., Odessa, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1657-60 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2925-30 (Oct. 1982). [received: April 1983]
The optical permittivity tensor of a covalent crystal is evaluated making allowance for the local field effects and the effect of a static exchange correlation interaction of valence electrons. A comparison of the calculated results with the standard random phase approximation for homogeneous systems indicates that the local field effects lead to a shift of the characteristic optical bands in the spectrum of a covalent crystal toward higher frequencies, but such a shift can be compensated by the exchange correlation interaction. (12 refs.)

68167 Dimensional effect in optical spectra of anthracene crystals. M.S.Brodin, A.N.Lipovchenko, S.V.Marisova, V.N.Myasnikov.
Ukr. Fiz. Zh. (USSR), vol.28, no.3, p.468-9 (March 1983). In Russian.
The authors found that the refractive index dispersion of anthracene crystals, changes when crystal thickness is reduced. This points towards the effective decrease in the oscillator strength of the excitonic transition in thin crystals. The results are discussed using a theory which takes into account the delay of the electromagnetic interaction in bounded crystals. (5 refs.) *V.G.P.*

How can a particle absorb more than the light incident on it? .... See Entry 64611

A simple theory to predict small changes in volume and refractivity during mixing of a two-component liquid system .... See Entry 64636

Measurement of absorption coefficients of highly transparent solids by emission spectroscopy .... See Entry 64960

Calculation of refractive indices using Buchdahl's chromatic coordinate .... See Entry 66204

The structure and the medium range order in thin amorphous germanium films prepared in UHV .... See Entry 66837

The optical absorption of F and F_H centres in cesium halides .... See Entry 66987

CO_2 laser oxidation of silicon .... See Entry 67045

Static properties of $CsliSO_4$ near the ferroelastic phase transition .... See Entry 67200

The electrical and optical properties of sodium germanate glasses .... See Entry 67271

Transparent conductive films of tin oxide-preparation and properties .... See Entry 67407

A study of the band structure of the $Co_{1-x}Cu_xCr_2S_4$ system of magnetic semiconductors by the diffuse reflection method .... See Entry 67449

Anomalous increase in the dielectric function of thin semiconducting films in contact with metals .... See Entry 67499

Electrical and optical properties of black phosphorus single crystals .... See Entry 67605

Optical properties and structure of very thin dielectric films ... See Entry 68130

Birefringence of $Zn_xCd_{1-x}S$ near the isotropic point .... See Entry 68168

Optical absorption spectrum of thulium acetate in solution ...... See Entry 68257

Hard carbon coatings with low optical absorption .... See Entry 68340

Microcrystal silicon film of 1.7 eV optical band gap .... See Entry 68341

Ellipsometric investigation of thin Permalloy films .... See Entry 68342

Effect of preparation technique and temperature on optical properties of amorphous silicon films .... See Entry 68344

Absorption in hydrogenated amorphous silicon at energies less than the optical band gap .... See Entry 68349

Some properties of reactively sputtered tin lead oxide films .... See Entry 68351

An improved method for the determination of the extinction coefficient of thin film materials .... See Entry 68352

Laser induced deposition of zinc oxide .... See Entry 68447

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition .... See Entry 68448

A study on the fabrication and the lanthanum dependence characteristics of (Pb, La) (Zr, Ti) O_3 ceramics .... See Entry 68482

78.20E Optical rotatory power

Anisotropic solutions of methylol cellulose .... See Entry 66804

78.20F Birefringence

(inc. stress birefringence, flow birefringence, etc)

68168 Birefringence of $Zn_xCd_{1-x}S$ near the isotropic point. W.Gunning, J.Tracy (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA), H.Rufer.
Appl. Opt. (USA), vol.22, no.8, p.1192-3 (15 April 1983).
The birefringence of the mixed crystal $Zn_{0.14}Cd_{0.86}S$ has been measured near its isotropic point and found to be highly dispersive. The region of strong dispersion shifts to shorter wavelengths than observed in pure CdS, and its magnitude near the isotropic point is larger. These results are highly significant for the development of narrowband dispersive birefringent filters in the blue-green region of the spectrum. (11 refs.)

68169 Birefringence study of a phase transition in TGS crystals. W.J.Kusto (Lab. of Appl. Phys., Delft Univ. of Technol., Delft, Netherlands).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.284-5 (March 1983).
Accurate measurements of the optical birefringence over the temperature range 20-80°C have been made for the uniaxial ferroelectric triglycine sulfate (TGS) along the ferroelectric b-axis. An anomaly at the Curie temperature is clearly seen. A slight deviation from Landau-like behaviour is observed in the temperature range $0°C \lesssim T\text{-}T_C \lesssim 7°C$, which is in agreement with recently obtained results on the dielectric, thermal and elastic properties. (11 refs.)

68170 'Four-fold' refringence in quartz. V.K.Semenchenko, I.T.Bodnar, V.A.Isupov (Inst. of Phys. of Solids & Semiconductors, Belorussian Acad. of Sci., Minsk, Belorussian SSR).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.375-81 (1983).
An attempt is made to interpret the simultaneous existence of four refractive indexes (two ordinary and two extraordinary) near the α-β phase transition in quartz from the optical point of view. The theory of thermodynamical stability predicts the appearance of fluctuation areas of the α- and β-phases in the vicinity of the α-β transition. On the basis of this theory the formation of infinite clusters, consisting of the merged fluctuation ranges, is assumed. (31 refs.)

Anisotropy induced in a silver chloride emulsion by two successive beams of white light perpendicularly polarized .... See Entry 64981

Linear dichroism studies of flavins in stretched poly(vinyl alcohol) films. Molecular orientation and electronic transition moment directions .. See Entry 66069

Influence of the fibre diameter on the stress birefringence in high-birefringence fibres .... See Entry 66400

Anisotropic solutions of methylol cellulose .... See Entry 66804

Measuring the degree of orientation of polymers by infra-red dichroism .... See Entry 66895

Static properties of $CsliSO_4$ near the ferroelastic phase transition .... See Entry 67200

Analytical and numerical calculations of the transient and the steady-state electric birefringence for a sudden application of a sinusoidal electric field of sufficient strength .... See Entry 68175

Light polarization by chains of highly dispersed Fe, Co, and Ni particles .... See Entry 68255

78.20H Piezo-, elasto- and acousto-optical effects

68171 Ultrasonic switching of a bistable liquid crystal cell. W.Hamidzada, S.V.Letcher (Dept. of Phys., Univ. of Rhode Island, Kingston, RI, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.785-7 (1 May 1983).
The response of a twisted nematic cell to a tone burst of ultrasound has been investigated. The cell is more sensitive than an ordinary nematic cell, and because it has two stable configurations, can store the acoustic signal. Over a wide range of acoustic pulse widths, the threshold for switching from one stable to the other depends on the total acoustic energy of the pulse. (15 refs.)

68172 Photoelastic properties of a two-level system in the field of a strong electromagnetic wave. G.N.Shkerdin (Inst. of Radio Engng. & Electronics, Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1575-7 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2782-6 (Sept. 1982). [received: April 1983]
The resonant acoustooptic interaction due to an electron polarizability of a two-level system in the field of a strong electromagnetic wave is studied theoretically. An expression for the permittivity of the system is derived in a situation when an acoustic wave is propagated in a crystal. It is shown that

under resonance conditions the amplitude of the permittivity modulation by an acoustic wave is determined by two mechanisms: the modulation by an acoustic wave of the energy of a resonance transition of the system and the modulation of the population of the levels in the system due to interference of different diffraction order of the electromagnetic wave propagated in the crystal. It is shown that a coupled system of equations for the amplitudes of diffraction orders becomes nonlinear when resonance transitions are saturated. The resulting dynamics of the acoustooptic interaction changes considerably when the saturation of resonance transitions by a diffracting electromagnetic wave takes place. (12 refs.)

68173 Acoustooptic parameters of calcium molybdate crystals. L.P.Avakyants, V.V.Antipov, D.F.Kiselev, N.G.Sorokin, K.V.Zakutailov (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1799-800 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3171-2 (Oct. 1982). [received: April 1983]
Optimisation of the parameters of acousto-optic devices requires the knowledge of the entire matrix of photoelastic constants. The authors measure all of the components of the elastic modulus and photoelastic constant tensors by the Brillouin scattering method. (4 refs.)

Raman investigation of the effects of torsion on fused silica optical fibers ....See Entry 66395

Epon 828 epoxy: a new photoelastic-model material ....See Entry 66530

Size effects in the Raman spectra of anatase ....See Entry 68208

High-resolution resonance Brillouin scattering and the effect of stress on GaAs ....See Entry 68249

Modulation-spectroscopy study of the $Ga_{1-x}Al_xSb$ band structure ....See Entry 68262

Complex isotope splitting of the no-phonon lines associated with exciton decay at a four-lithium-atom isoelectronic centre in silicon .... See Entry 68304

78.20J Electro-optical effects

68174 Study of the electrochromic effect in vanadium and tungsten oxides. V.I.Gavrilyuk, I.M.Chernenko.
Inorg. Mater. (USA), vol.18, no.7, p.993-4 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1176-8 (July 1982). [received: Feb. 1983]
Study of the electrochromically colored oxides of vanadium (V) and tungsten (III) by IR spectroscopy and proton magnetic resonance showed that together with the probable injection of positive ions into V_2O_5, the predominant process during electrochromic coloring of vanadium oxide, in contrast to tungsten trioxide, is an electrochemical reduction as a result of which an oxygen-defect layer is formed in the surface region of the V_2O_5 sample. (4 refs.)

68175 Analytical and numerical calculations of the transient and the steady-state electric birefringence for a sudden application of a sinusoidal electric field of sufficient strength. H.Watanbe (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan), A.Morita.
J. Chem. Phys. (USA), vol.78, no.9, p.5311-16 (1 May 1983).
The transient and the steady-state electric birefringence for a sudden application of a sinusoidal electric field $E(t)=E_0 \cos \omega t$ of sufficient field strength was studied. An analytical expression which is valid up to the fourth power of E was obtained. For stronger electric fields, the electric birefringence was calculated numerically by making use of the Runge-Kutta-Gill method. The effect of the field strength on the dispersion of the birefringence was demonstrated for several ratios of the contribution of the permanent dipole moment and the induced dipole moment. The contribution of harmonics in the birefringence signals in the nonlinear region is expressed as the Fourier components of the signals. (7 refs.)

68176 A possible mechanism of light absorption. S.L.Kraevskii.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.824-8 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.116-22 (July 1982). [received: March 1983]
The author discusses the electrochromism effect in amorphous films and glasses, and the opinion that light is absorbed by polarons of small radius (PSR). It is shown that the application of this mechanism encounters appreciable difficulties, and a different mechanism is proposed which takes into account the interaction of injected electrons with each other and with the cation-compensators of an injected charge. (16 refs.)

68177 Initial stage in the redistribution of photoinduced charges and electric fields in $Bi_{12}SiO_{20}$. V.V.Bryksin, L.I.Korovin, V.I.Marakhonov, A.V.Khomenko (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1686-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2978-84 (Oct. 1982). [received: April 1983]
The dynamics of the electric field distribution in a photorefractive crystal is discussed for the case of a uniformly illuminated sample and a direct photocurrent. It is shown that for times less than the trap thermal ionization time the field has a maximum as a function of the coordinate, which moves away from the illuminated electrode at a rate which decreases to zero in the course of time. Thereafter, the maximum remains stationary but increases linearly with time. The coordinate dependence of the field was measured for $Bi_{12}SiO_{20}$ samples with exposures corresponding to the arrest time of the maximum with various external fields. Comparison of theory and experiment gave a value for the photocarrier mobility in the conduction band multiplied by the band electron trapping time. (9 refs.)

68178 A more exact formula for Kerr effect in liquids and a comparison with experiment. M.F.Vuks.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.6-14 (Feb. 1983). In Russian.
A more exact formula for the Kerr constant in liquids is derived. The comparison of the theoretical values with experimental ones for many polar and nonpolar liquids shows a satisfactory agreement in the absence of dipole association. (19 refs.)

Demonstrations of some optical properties of liquid crystals ...See Entry 64640

Holography, coherent light amplification and optical phase conjugation with photorefractive materials ....See Entry 66240

Two-photon self-induced transparency and diffraction phenomena ....See Entry 66350

Flexoelectric effect in MBBA in strong electric fields ....See Entry 66825

Features of the behavior of a ferroelectric liquid crystal in alternating fields ....See Entry 66826

Inner differentiation of growth sectors induced by the interaction between dislocations and sector boundaries in KH_2PO_4 crystals ....See Entry 67030

Spontaneous polarization of Langmuir multimolecular films ....See Entry 68112

Modulation-spectroscopy study of the $Ga_{1-x}Al_xSb$ band structure ....See Entry 68262

Impact ionization of exciton states and the Stark effect in pure CdS crystals ....See Entry 68327

78.20L Magneto-optical effects

68179 Nonlinear far-infrared magnetoabsorption and optically detected magnetoimpurity effect in *n*-GaAs. C.R.Pidgeon, A.Vass, G.R.Allan (Dept. of Phys., Heriot-Watt Univ., Edinburgh, Scotland), W.Prettl, L.Eaves.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1309-12 (25 April 1983).
Measurements have been made of CW nonlinear far-infrared magnetoabsorption in pure, partially compensated *n*-GaAs. A new optical observation of the magnetoimpurity resonance has been demonstrated. Analysis in terms of a three-level model gives effective lifetimes of ~ 0.5 μs 'off resonance' and 30 ns 'on resonance', implying the possibility of laser action in the former case. (10 refs.)

68180 Laser-induced magneto-optical transitions from deep levels in n-InSb. D.G.Seiler, M.W.Goodwin, K.H.Littler (Center for Appl. Quantum Electronics, Dept. of Phys., North Texas State Univ., Denton, TX, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.167-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Oscillatory structure in the magneto-photoconductivity induced by CO_2 and CO lasers in high purity n-InSb at liquid helium temperatures is shown to arise from deep levels located ≈ 74 and ≈ 170 MeV below the conduction band. (3 refs.)

68181 Magneto-optics of cadmium arsenide. M.Singh, P.R.Wallace (Service des Champs Magnetiques Intenses, CNRS, INSA, Toulouse, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.441-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Using the band structure model of Bodnar (1977) the authors have calculated the frequency and wavenumber dependent electronic dielectric tensor of Cd_3As_2 in the presence of a magnetic field, for arbitrary direction of the field relative to the c-axis of the crystal. This involves calculating not only the energy levels but also the 8-component wave functions and the current matrix elements. The magneto-optical properties of the material in both the Faraday and Voigt configuration are discussed on the basis of this calculation. (5 refs.)

68182 Magnetooptical study of semimagnetic alloys $Cd_{1-x}Mn_xTe$. G.Rebmann (Groupe de Phys. des Solides, Ecole Normale Superieure, Paris, France), C.Rigaux, G.Bastard, M.Menant, R.Triboulet, W.Giriat.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.452-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The splitting of the exciton state in magnetic field is studied by reflectance experiment on concentrated $Cd_{1-x}Mn_xTe$ alloys. A linear decrease of the splitting is observed as a fuction of x, inferring a zero magnetization for $x_0 \sim 0.61$ corresponding to the antiferromagnetic phase transition. Absorption spectra of concentrated alloys show several absorption bands resulting from the excitation of manganese 3d states. (16 refs.)

68183 Simple methods for analyzing interband magneto-optical data of Kane-type semiconductors: application to Cd_3As_2. J.-P.Jay-Gerin (Dept. de Medecine Nucleaire et de Radiobiologie, Univ. de Sherbrooke, Sherbrooke, Quebec, Canada), E.K.Arushanov, M.J.Aubin.
Solid State Commun. (USA), vol.46, no.7, p.537-40 (May 1983).
Three simple methods are derived for analyzing interband magneto-optical data of isotropic Kane-type semiconductors yielding straight line plots from which band structure information is determined. To illustrate the results, data obtained with cadmium arsenide (Cd_3As_2) are analyzed. (12 refs.)

68184 Interference spectra of magnetic polaritons. V.P.Kochereshko, G.V.Mikhailov, I.N.Ural'tsev (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1529-33 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2697-704 (Sept. 1982). [received: April 1983]
Optical dispersion of the exciton ground state is studied by the spectrum interference analysis method of thin CdSe crystals. A comparison of the calculated dependences of the dispersion of the refractive index of optical exciton waves on the magnetic field with the observed transmission spectra can be used to determine the dispersion parameters of a magnetic polariton and study their dependences on the magnetic field. The first observation of a magnetogyration effect of optical exciton waves is reported. (11 refs.)

68185 The nature of the Faraday effect in the paramagnetic rare earth garnet $Tb_3Ga_5O_{12}$. U.V.Valiev, G.S.Krinchik, S.B.Kruglyashov, R.Z.Levitin, K.M.Mukimov, V.N.Orlov, B.Yu.Sokolov (V.I. Lenin State Univ., Tashkent, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1596-7 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2818-20 (Sept. 1982). [received: April 1983]
The authors report the results of measurements of the Faraday rotation and the magnetic susceptibility of gallium terbium garnet $Tb_3Ga_5O_{12}$ which is paramagnetic to 0.8K. The measurements of the Faraday effect and of the susceptibility were carried out on the same samples, which were in the form of 1 mm thick disks, cut along the (111) plane from single crystals that were grown from solution in the melt. The Faraday rotation was measured at the laser wavelengths 0.63 and 1.15 μ in the temperature range 85-300K by the method involving magnetooptical modulation of the angle of rotation. (8 refs.)

Proceedings of the 10th International Colloquium on Magnetic Films and Surfaces ....See Entry 64579

Proton Zeeman and dipolar relaxation study of the ferroelectric liquid crystal DOBAMBC ....See Entry 66819

Investigation of bandmasses and G-values by two-photon-magneto-absorption (TPMA) in ZnSe ....See Entry 67431

Influence of exchange interaction on band structure of $Pb_{1-x}Mn_xTe$ ....See Entry 67445

Faraday rotation in the lowest exciton resonance of gallium arsenide ....See Entry 67462

Dependence of a hydrogen-like impurity spectrum on the magnetic field orientation in the crystal ....See Entry 67537

Photomagnetoresistance $Cd_{1-x}Mn_xTe$ ....See Entry 67685

Modulation of the electrical conductance of phthalocyanine films by circularly polarized light ....See Entry 67821

Investigation of magnetic after-effect in cobalt-doped thin garnet films ....See Entry 67971

Magnetic and magneto-optical properties of bismuth-substituted gadolinium iron garnet films ....See Entry 67981

Cyclotron resonance and impurity absorption in tellurium under pressure in the submillimeter range ....See Entry 68029

Spin-flip Raman scattering, bound magnetic polaron, and fluctuations in (Cd,Mn)Se ....See Entry 68226

Magnetically tunable stimulated emission with recombination radiation in (Cd,Mn)Se ....See Entry 68267

Far-infrared magneto-dynamics of photoexcited electron system in gallium arsenide ....See Entry 68277

Zeeman spectroscopy of cobalt doped InP ....See Entry 68279

Spin-polarization and spin-memory effects in the *F*-center absorption and *F′* conversion of NaI and NaBr crystals ....See Entry 68283

Magnetic depolarization of hot photoluminescence in gallium arsenide crystals ....See Entry 68290

Optical resonance cooling of the nuclear spin system in a semiconductor with an anisotropic *g* factor ....See Entry 68324

Optical four-wave mixing spectroscopy of PbSe epitaxial layers ....See Entry 68345

Thickness dependence of the polar Kerr effect in thin ferromagnetic films ....See Entry 68353

78.30 INFRARED AND RAMAN SPECTRA AND SCATTERING

68186 Identification of pentachlorobiphenyl isomers by application of diffuse reflectance Fourier transform infrared spectroscopy. R.A.Nyquist, C.L.Putzig, D.P.Peterson (Analytical Labs., Dow Chem. Co., Midland, MI, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.140-53 (March-April 1983).
The IR spectra presented are useful for scientists engaged in the isolation and identification of polychlorobiphenyl isomers via spectral comparison. The IR correlations presented should also be useful in the identification of other polychlorobiphenyl isomers, especially in cases where the mass spectral data for the corresponding fractions are also available. (5 refs.)

68187 Investigation of Raman spectra of $LiNbO_3$:MgO crystals. Liu Si-min, Zhang Guang-yin (Dept. of Phys., Nankai Univ., Tianjin, China).
Acta Phys. Sin. (China), vol.32, no.1, p.103-7 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
Raman spectra of $LiNbO_3$:MgO crystals has been obtained for the first time and compared with Raman spectra of pure $LiNbO_3$ crystals. No change of the number, frequency, and relative intensity of Raman spectra lines of $A_1(TO)$ and $E(TO)$ mode is found. There are only a very little increase in the line width. It is shown from this result that the more intensive Raman spectral lines of $A_1(TO)$ and $E(TO)$ vibrational mode are contributed by (NbO_6) oxygen octahedra characteristic group of $LiNbO_3$ crystals. (15 refs.)

68188 Raman spectra and structural phase transitions of the perovskite-type layer compounds $RbAlF_4$ and NH_4AlF_4. M.Couzi, P.L.Loyzance, R.Mokhlisse (Lab. de Spectroscopie Infrarouge, Univ. de Bordeaux I, Talence, France), A.Bulou, J.L.Fourquet.
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.232-5 (March 1983).
The low frequency (0-600 cm^{-1}) Raman spectra of $RbAlF_4$ and NH_4AlF_4 single crystals have been studied at different temperatures ranging from 20 to 600K, in their various structural modifications. It is concluded that the transition of NH_4AlF_4 occurring at ~150K is purely an order-disorder transition, governed by the reorientational dynamics of the NH_4^+ ions. For $RbAlF_4$, the observed phase transitions at 553 and 282K are both related to displacive mechanisms, as evidenced by the observation of soft-modes, but also to disordering processes probably connected with the AlF_6 octahedra. (12 refs.)

68189 Phase transition and vibrational spectra of l-leucine. D.Bougeard (Inst. fur Phys. & Theoretische Chem., Univ. Essen, Essen, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.279-83 (March 1983).
A phase transition was observed at 80°C in crystalline l-leucine. The transition heat was estimated to 170 J/mol by a DSC measurement. The analysis of the IR- and Raman spectra and some MNDO conformational analyses show that the transition is purely of conformational type without disorder effect, mostly localized in the alkyl side chain and nearly without effect on the double layer structure. (17 refs.)

68190 Surface-enhanced Raman study of the solid/liquid interface: conformational changes in adsorbed molecules. C.J.Sandroff, S.Garoff, K.P.Leung (Exxon Res. & Engng. Co. Corporate Res.-Sci. Labs., Linden, NJ, USA).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.547-51 (22 April 1983).
Surface-enhanced Raman scattering was seen from 1-hexadecane thiol adsorbed on silver-island films. The adsorbed amphiphile in contact with air and water exhibited similar trans, or solid-like structures. In contact with chloroform which wets the thiol-coated film, there was a decrease in the number of trans conformations. (13 refs.)

68191 Novel features in the stereochemistry of octacyanides: phase transition in tetra-n-butylammonium octacyanotungstate(V). A.Samotus, A.Kanas, S.Hodorowicz, J.Czerwonka (Inst. of Chem., Jagiellonian Univ., Krakow, Poland), J.Sciesinski, Cz.Paluszkiewicz.
Polyhedron (GB), vol.1, no.11-12, p.779-80 (1982).
Tetra-n-butylammonium octacyanotungstate(V) has been found to exist in three phases at the temperature range 90-353K. The IR and ^{1}H-NMR spectra as well as thermogravimetric and power diffraction studies support these structural changes. The phase transitions were found in the temperature range 273-283K (T_1) and 33-343K (T_2). (8 refs.)

68192 Characters of local dynamics and local structure inferred from far infra red spectroscopy. A.Gerschel (Chimie Phys. des Materiaux Amorphes, Univ. Paris Sud, Orsay, France).
J. Mol. Liq. (Netherlands), vol.25, no.1, p.51-78 (March 1983).
The author provides a review of molecular liquids which deal with the state of progress, the identification of basic problems and tentative suggestions as how research on basic problems might be organized. He stresses some main uses, teachings and limits of FIR spectroscopy in pure dipolar liquids. He explains to what extent experimental bandshapes and band intensities can be useful to specify some general features of the dynamics and structure in simple molecular liquids. (31 refs.)

68193 Study of the structure of strontium- and titanium-containing aluminosilicate glass by Raman scattering. N.M.Bobkova, N.A.Borushko, L.M.Silich (Polytech. Inst., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.5, p.718-20 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.856-8 (May 1982). [received: Feb. 1983]
Using the method of Raman scattering, it was found that there are $[TiO_4]$ and $[TiO_5]$ groups, but no $[TiO_6]$ group in the structure of strontium- and titanium-containing aluminosilicate glass. Six-coordinate titanium only appears in crystallization of glass in the form of anatase and rutile, as confirmed by the findings of X-ray diffraction analysis. (6 refs.)

68194 Optical absorption below the absorption edge in $Hg_{1-x}Cd_xTe$. J.A.Mroczkowski, D.A.Nelson (Electro-Optics Operations, Honeywell, Lexington, MA, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2041-51 (April 1983).
The optical absorption below the absorption edge in $x=0.2$ and $x=0.3$ $Hg_{1-x}Cd_xTe$ alloys has been investigated. In *p*-type alloys of both compositions and at wavelengths equivalent to approximately 0.75 E_g to 20 μm, the measured optical absorption cross sections at 90 K were close to the intervalence cross sections calculated using first-order Kane **k.p** theory with a bandstructure parameter P of 8.4×10^{-8} eV cm and a heavy hole mass of 0.5 m. For $Hg_{0.8}Cd_{0.2}Te$ the absorption cross sections were close to 1.8×10^{-15} cm^2 for wavelengths between 15 and 20 μm. For $Hg_{0.7}Cd_{0.3}Te$, the absorption cross sections increased approximately 1×10^{-15} cm^2 at 5 μm to about 3×10^{-15} cm^2 at 20 μm. At higher temperatures the intervalence absorption cross sections decreased; in addition, an intraband contribution to the total hole absorption cross section was observed. (29 refs.)

68195 Scattering activities and symmetry of skeletal stretching vibrations of long chain molecules by Raman spectroscopy. M.Harrand (Lab. de Recherches Optiques, Univ. de Reims, Reims, France).
J. Chem. Phys. (USA), vol.78, no.7, p.4777-9 (1 April 1983).
Because of crystal splitting, polarized Raman spectra of crystalline *n*-paraffins give incomplete informations on chain modes. On the contrary, with the oriented samples obtained by Peticolas' drops method (1982), it is possible to deduce the vibration symmetry of the chains of dipalmitoylphosphatidylcholine (DPPC), uniaxially oriented as confirmed by spectra. The planar zig-zag configuration of the carbon skeleton is characterized by two stretching vibrations ν_s(C-C) and ν_a(C-C). Contrary to the $\nu(CH_2)$ Raman lines of oriented DPPC, strong in the *YY* polarization, the ν(C-C) lines are weak: The strongest intensity of ν_s (1126 cm^{-1}) and ν_a (1062 cm^{-1}) is observed in *ZZ* and *ZX* respectively, although one expects the opposite when considering the motions of carbon atoms. To explain this anomaly the author calculates the Raman scattering tensors of the skeletal vibrations from tensors attributed to the isolated C-C bond. (7 refs.)

68196 The OH stretching spectrum of liquid water: a random network model interpretation. A.C.Belch, S.A.Rice (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4817-23 (15 April 1983).
The authors report the results of an analysis of the OH-stretching region of the vibrational spectrum of liquid water. The random network model is realized by time-averaged molecular dynamics configurations of ST-2 water. The hydrogen bond network is defined using a geometric definition of bonded pairs of molecules. Force constants are calculated using empirically derived formulas relating the shifts of the intramolecular frequency and anharmonic potential energy coeficients with a hydrogen bond strength parameter. The strength parameter is related to the separation in a molecular pair, hence, it has a distribution of values defined by the molecular configuration in the model liquid. Fermi resonance between the OH stretching mode and the bending overtone is shown to be an important second-order effect in the spectral band shape. The calculated spectra compare well with experimental results and support the contention that the spectral features are dominated by intermolecular interactions. (23 refs.)

68197 An improved analysis of the OH stretching spectrum of amorphous solid water. G.Nielson, S.A.Rice (James Franck Inst., Univ. of Chicago, Chicago, IL, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.4824-7 (15 April 1983).
The authors report a calculation of the OH stretching region of the infrared and Raman spectra of amorphous solid water. The configuration space distribution of water molecules employed as a realization of the amorphous solid is a modified scaled version of the Henderson model of amorphous Ge. The molecular dynamics includes, in addition to interaction between OH oscillators, local variation of hydrogen bending strength, anharmonicity of the OH stretching motion, and Fermi resonance between the overtone of the HOH bending motion and the OH stretching motion. A comparison with available experimental data is made and is used to analyze some of the shortcomings of the configuration space model and the dynamical analysis. (7 refs.)

68198 Raman scattering study of pressure effects on the structure and the coordination-induced charge redistribution in 4-cyanopyridine. P.T.T.Wong (Div. of Chem., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.8, p.4840-51 (15 April 1983).
The Raman spectra in the frequency regions of the lattice and the internal modes of the crystalline CNPy and $Zn(CNPy)_2Cl_2$ have been measured at various pressures up to 16.5 and 20 kbar, respectively. A structural phase transition at 10 kbar in CNPy and two at 8.2 and 18 kbar in $Zn(CNPy)_2Cl_2$ were observed. At high pressure, CNPy suffers a lattice distortion along the eigenvector of a soft phonon, and $Zn(CNPy)_2Cl_2$ undergoes a molecular configuration distortion which leads to the softening of a rotational phonon. The charge distribution on the CNPy molecule is changed by coordination and also by external pressure and this charge redistribution has been correlated with the vibrational spectral changes. (39 refs.)

68199 Raman and visible-ultraviolet spectra of polyhalide anions in molten I_2/KI-LiI, I_2/CsCl-LiCl, and I_2-ICl/CsCl-LiCl. W.C.Child,Jr. (Dept. of Chem., Carleton Coll., Northfield, MN, USA), G.N.Papatheodorou.
J. Phys. Chem. (USA), vol.87, no.2, p.271-5 (20 Jan. 1983).
Molten eutectic mixtures of KI-LiI and CsCl-LiCl at 300-400°C were equilibrated with I_2 vapor or I_2-ICl vapor at pressures of 0.002-2 atm and were investigated by means of Raman and visible-UV spectroscopy. The observed polarized Raman bands were attributed to the symmetric stretching vibrations of I_3^-(112 cm^{-1}), I_2Cl^- (184 cm^{-1}), and ICl_2^-(271 cm^{-1}). Further evidence for the presence of these trihalide anions in the melts was given by the visible-UV spectra. A band at 161 cm^{-1} in the Raman spectrum of the I_2/KI-LiI melt was attributed to a polyiodide of higher molecular weight than the triodide. There is evidence for the disproportionation of I_2Cl^- in the I_2/CsCl-LiCl melt. (21 refs.)

68200 Temperature study of infrared reflection spectra on various faces of MTPP(TCNQ)$_2$ single crystals. R.Swietlik, A.Graja (Inst. of Molecular Phys., Polish Acad. of Sci., Poznan, Poland).
J. Phys. (France), vol.44, no.5, p.617-21 (May 1983).
Crystals of the ion-radical salt MTPP(TCNQ)$_2$ undergo a first-order structural phase transition at the temperature $T_p=315.7K$. This phase transition has a pronounced influence on the infrared spectra. In this paper the authors present and discuss the infrared spectra of MTPP(TCNQ)$_2$ as a function of temperature. During thermal cycling they have observed an interesting thermal hysteresis of the reflection coefficients for different bands. Moreover, they have related the observed spectral modifications with the enthalpy of the phase transition. (14 refs.)

68201 Impurity effect on the Raman spectra of $Sr_{0.6}Ba_{0.4}Nb_2O_6$. S.Kuroda, K.Kubota (School of Sci., Kwansei Gakuin Univ., Nishinomiya, Japan).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.527-30 (1983).
The impurity effect on the rare earth ion doped $Sr_{0.6}Ba_{0.4}Nb_2O_6$(SBN40) was studied at room temperature. Doping with the rare earth ions of Pr^+ or Nd^{3+} changed the Raman profile: spectral broadening, central frequency shifts and the relative intensity decreasing. Two reasons are considered according to the ferroelectric and optical properties of the rare earth ion doped SBN40: impurity-induced crystal disorder and the crystal structure change. SBN40 is the general disorder crystal and the disorder which is enhanced by doping the rare earth ion is especially strong along the *x-y* plane of the material compared with that along the polar *c*-axis. (13 refs.)

68202 A thermal and Raman investigation of the phase transitions above room temperature in anhydrous potassium acetate. T.E.Jenkins (Phys. Dept., Univ. of St. Andrews, St. Andrews, Scotland), P.O'Brien.
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.565-8 (1983).
Results using thermal and Raman techniques are presented on the phase transition in potassium acetate occurring above room temperature. Two phase transitions are observed at $Tc1=349K$ and $Tc2=413K$. The magnitude of the entropy change at $Tc1$ and the Raman results suggest that this transition is orientational in nature and is due to rotation of the acetate ion about the *c-c* axis. The $Tc2$ transition is displacive in nature, and the Raman results show a marked softening of the lowest frequency mode as $Tc2$ is approached from below. (6 refs.)

68203 Infrared spectra of $KNaSO_4$ and $K_3Na(SO_4)_2$. M.Natarajan, E.A.Secco (Dept. of Chem., St. Francis Xavier Univ., Antigonish, Nova Scotia, Canada).
J. Solid State Chem. (USA), vol.47, no.2, p.231-5 (April 1983).
The infrared spectra, transmittance and polarized reflectance, of $KNaSO_4$ and $K_3Na(SO_4)_2$ are reported. Group theoretical analysis was carried out and a vibrational assignment proposed on basis of C_{3v} and D_{3d} symmetries. Factor group and site effects are discussed. (7 refs.)

68204 Intramolecular vibrations in ICE. Interpretation of experiments on the isotopic isolation of H_2O molecules. Yu.Ya.Efimov (Inst. of Chemical Kinetics & Combustion, Acad. of Sci., USSR).
J. Struct. Chem. (USA), vol.23, no.3, p.407-14 (May-June 1982). Translation of: *Zh. Strukt. Khim. (USSR)*, vol.23, no.3, p.101-9 (May-June 1982). [received: Feb. 1983]
Machine modeling of the form of the bands in the vibrational spectra of H_2O molecules diluted in the lattice of cubic ice D_2O has been carried out. Experimental data recently obtained on infrared absorption and anisotropic Raman scattering have been explained. The form of the spectra of the isotropic Raman scattering has been predicted. The parameters, not perturbed by collective interactions, of water molecules in the three-dimensional network of H-bonds characteristic of pure ice have been calculated; the expected effect of the variation of some of them on the spectral contours has also been calculated. The existence of a statistical distribution of the energy of the hydrogen bond in the specimens of mixed ice H_2O+D_2O studied has been confirmed, and the corresponding distribution of the equilibrium internuclear distances estimated. (23 refs.)

68205 Raman studies of B_2O_3 glass structure: $^{10}B\rightarrow{}^{11}B$ isotopic substitution. F.L.Galeener, A.E.Geissberger (Xerox Palo Alto Res. Centers, Palo Alto, CA, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.343-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Reports the $^{10}B\rightarrow{}^{11}B$ isotope shifts of the Raman spectra of vitreous B_2O_3. The authors interpret the unshifted lines (450 and 808 cm^{-1}) in terms of extended and localized modes (respectively) of a network of boroxol rings. (10 refs.)

68206 Raman study of $xB_2O_3.(1-x)SiO_2$ glasses obtained by hot pressing of gels. L.Beys, M.Abenoza, P.Hillaire, J.Phalippou (Lab. de Spectroscopie I, Univ. des Sci. & Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.355-8 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The glasses of the binary system $xB_2O_3(1-x)SiO_2$ (where $0<x\leq0.2$) were elaborated by the hot pressing of the gels. Raman spectra of these glasses are reported. The Raman line situated at 808 cm^{-1} shows that boroxol groups are present in the glass structure, even for low B_2O_3 content. The bands situated at 679 and 931 cm^{-1}, the intensity of which changes with B_2O_3 content, reveals the presence of B-O-Si bonds in the structure of these glasses. It was thought that a critical zone composition corresponding to $x=0.10$-0.15 distinguishes the respective composition range where planar structural units BO_3 and boroxol groups are present for the most part in the glass-structure. (14 refs.)

68207 Raman study of geometrical disorder at semiconductors surfaces. R.Carles, J.B.Renucci, A.Zwick, M.A.Renucci (Lab. de Phys. des Solides, CNRS, Toulouse, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.363-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Geometrical disorder is induced at the surface of samples by rough mechanical polishing. Its influence on both vibrational and electronic properties are reported in InSb, InAs and GaSb. (9 refs.)

68208 Size effects in the Raman spectra of anatase. Ya.S.Bobovich, M.Ya.Tsenter.
Opt. & Spectrosc. (USA), vol.53, no.3, p.332-3 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.562-3 (Sept. 1982). [received: May 1983]
The authors have made a study of samples of Sitall, which is a composite material produced by subjecting complex glasses to a special heat treatment that results in their volume crystallization. Interest was focused on the Raman spectra of one structural component of Sitall: titanium dioxide, which precipitates in the form of anatase with typical crystal radii of $\sim$20 Å. The authors measured the frequency and halfwidth of the two anatase bands at 144 and 642 cm^{-1} at various sample temperatures and at various values of external hydrostatic pressure applied to the sample. (10 refs.)

68209 Nature of the active site in surface-enhanced Raman scattering. T.E.Furtak, D.Roy (Dept. of Phys., Rennselaer Polytech. Inst., Troy, NY, USA).
Phys. Rev. Lett. (USA), vol.50, no.17, p.1301-4 (25 April 1983).
Experiments involving competitive and cooperative adsorption of pyridine, Cl^-, SCN^-, and Tl and voltage induced resonance shifting show that the largest surface-enhanced Raman scattering intensity comes from complexes of these species adsorbed in defects which cover less than 3% of the Ag surface. The resonance is attributed to charge transfer excitation from Ag to pyridine and from SCN^- to Ag which is communicated to all vibrations of the complex. (11 refs.)

68210 Effect of non-magnetic impurities on the observation of superconducting gap excitations by Raman scattering. G.C.Mohanty, S.N.Behera (Inst. of Phys., Bhubaneswar, India).
Pramana (India), vol.19, no.6, p.645-63 (Dec. 1982). [received: April 1983]
The effect of small concentrations of non-magnetic substitutional impurities (characterized by changes in mass, nearest neighbour force constants and local electron-phonon interaction) on the observability of superconducting (SC) gap excitations in 2H-$NbSe_2$ by Raman scattering is considered within the theoretical framework of Balseiro and Falicov (1980) (BF). The phonon self-energy when evaluated for $q=0$ using the Einstein oscillator model for the host phonons is seen to have a pole corresponding to the impurity mode besides the gap excitation one around 2Δ previously obtained by BF. A splitting of the impurity mode into two in the SC state is predicted. An enhancement occurs in the strength of the SC gap excitation peak whenever it is close to the impurity mode. The data from the experiments of Sooryakumar, Klein and Frindt (1981) on impure samples of 2H-$NbSe_2$ are discussed in the light of the present calculation. (11 refs.)

68211 Resonant Raman scattering at the indirect triplet exciton in AgBr in high magnetic fields. H.Stolz, W.Wassmuth, W.von der Osten (Univ. Gesamthochschule Paderborn, Paderborn, Germany), Ch.Uihlein.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.383-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Resonant two-phonon Raman scattering involving the indirect triplet exciton is studied in AgBr at $T=1.8K$ and magnetic fields up to 20 Tesla. By a quantitative analysis of the scattered 2TO(L) intensity the authors are able to determine the symmetry of hole states to be $L^-{}_{4,5}$, the exchange splitting $\Delta=0.17$ meV and effective g-values of $g_c=1.46$ and $g''{}_v=2.61$ for electrons and holes. The observed diamagnetic shifts lead to a value of 32 meV for the exciton binding energy. (7 refs.)

68212 Optical pumping of hot phonons in GaAs. C.L.Collins, P.Y.Yu (Dept. of Phys., Univ. of California, Berkeley, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.386-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Optical pumping of hot LO phonons in GaAs has been studied as a function of the excitation photon frequency. The experimental results are in good agreement with model calculation which includes both inter- and intra-valley electron-phonon scatterings. The Γ-L and Γ-X intervalley electron-phonon interactions in GaAs have been estimated. (15 refs.)

68213 Bound magnetic polarons and spin-flip Raman scattering in (Cd, Mn)Se. D.Heiman, P.A.Wolff, J.Warnock (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.485-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Spin-flip Raman scattering is used to determine the spin-flip energy ΔE as a function of applied field and temperature in (Cd,Mn)Se. At moderate B-fields, ΔE is approximately proportional to B/T resulting from mean-field behavior. At low fields, ΔE is described by a statistical mechanical model of bound magnetic polarons. Thermodynamic fluctuations of the magnetic ions are included by calculating the partition function in a general way using an exchange Hamiltonian. At $B=0$ the theory predicts the line-width and line-shape. (10 refs.)

68214 Raman study of Ge and GaP microcrystals. S.Hayashi, H.Kanamori (Dept. of Electrical Engng., Kyoto Tech. Univ., Kyoto, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.520-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Raman scattering from Ge and GaP microcrystals prepared by gas evaporation technique has been investigated. In the case of Ge, the existence of amorphous particles of the order of 80 Å in diameter was demonstrated. For crystalline Ge particles the size dependence of Raman spectra was observed. In the case of GaP, the surface phonon mode was clearly observed when the particles are about one order of magnitude smaller than the wavelength of incident laser radiation. (5 refs.)

68215 Microscopic theory of Raman and infrared spectra of transition metal dichalcogenides in CDW state. N.Nagaosa, E.Hanamura, S.Uchida (Dept. of Appl. Phys., Univ. of Tokyo, Tokyo, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.526-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Multi-phonon processes, hybridization of oscillator strength and interference of dia- and para-magnetic contributions to Raman intensity are discussed to understand the dynamics of the electron-phonon coupled CDW system. (7 refs.)

68216 Vibrational properties of silicon networks with vacancy, hydrogen, or fluorine. K.Suzuki (Max-Planck-Inst. fur FKF, Stuttgart, Germany), A.A.Maradudin.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.529-31 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The vibrational spectra of silicon networks with and without a vacancy are calculated using the real space version of the recursion (continued fraction) method for clusters containing approximately 18000 atoms. Results are discussed in the light of infrared and Raman measurements on amorphous silicon containing hydrogen or fluorine. (21 refs.)

68217 Lifetimes of LO phonons in GaP. J.Kuhl, W.E.Bron (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.532-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The decay of coherent LO phonons in GaP has been analyzed by time resolved coherent anti-Stokes Raman scattering. The measured lifetimes decrease from 26.0±2.5 ps at 5K to 6.7±0.3 ps at 300K. (6 refs.)

68218 Theory of electronic Raman scattering from n-$KTaO_3$. S.Katayama (Dept. of Phys., Osaka Univ., Toyonaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.576-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A theory of Raman scattering by the low-lying coupled plasmon-longitudinal optical (LO) phonon modes (L_-) in n-$KTaO_3$ is presented by taking into account the soft mode-like behavior of the L_- modes induced by the strong polar electron-LO phonon coupling at low temperatures. The electronic inter-band Raman scattering between the conduction band and its split-off upper subband is also theoretically explored, with emphasis on the temperature variation of the spectral line width. The calculations are in good agreement with the recent experiments. (6 refs.)

68219 Generalized electronic susceptibility and charge density waves in transition metal dichalcogenides. S.Sugai (Dept. of Phys., Osaka Univ., Toyonaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.587-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Lattice vibrations in 2H-$TaSe_2$ and 2H-$NbSe_2$ are investigated by one- and two-phonon Raman scattering in the normal and charge density wave (CDW) phases. The generalized electronic susceptibility is obtained from the two-phonon scattering intensity as a function of temperature, and with its use the temperature dependent energies of the Kohn anomaly mode and the soft CDW modes are calculated. The agreement with the directly obtained data from this experiment is excellent. In 2H-$TaSe_2$ four A_g-modes and two B_{1g}-modes are observed in the commensurate CDW state as expected from the orthorhombic superlattice structure. The discommensuration in the incommensurate CDW phase gives the continuous change of the Raman spectra over the three CDW phases. (6 refs.)

68220 Raman scattering from hydrogenated amorphous silicon. S.A.Lyon (Dept. of Electrical Engng., & Computer Sci., Princeton Univ., Princeton, NJ, USA), R.J.Nemanich.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.871-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The Raman scattering from amorphous silicon has been obtained to within 7 cm^{-1} of the exciting laser line. For hydrogenated silicon the Raman intensity does not go to zero at zero frequency as expected for a Debye solid. Instead the Raman spectrum is essential flat for energy shifts below approximately 50 cm^{-1}. Amorphous silicon without hydrogen, produced by ion implantation of arsenic into single crystal silicon, showed at least a factor of 5 less scattering at low energies than heavily hydrogenated films. The temperature dependence of the intensity of the low frequency scattering could not be described by usual one-phonon or two-phonon processes. Similar low frequency scattering has been previously observed from glasses and interpreted in terms of thermally activated relaxation of two-level systems. The data indicate that the incorporation of hydrogen in amorphous silicon produces two-level systems. (17 refs.)

68221 New silicon hydrogen infrared vibrational band associated to H-Si-Cl configurations in an amorphous silicon matrix: Green's function theory approach. J.Chevallier, S.Kalem, J.Bourneix (LPS, CNRS, Meudon, France), M.Vandevyver.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.874-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The infrared transmission spectra of hydrogenated and chlorinated amorphous silicon samples show the appearance of a new silicon hydrogen induced band at 740 cm^{-1}. This band is due to HSiCl species where hydrogen and chlorine are bound to the same silicon atom. Green's-function theory is used in order to calculate the localized vibrational mode frequencies of various SiX, SiX_2 and SiXX′ species. (9 refs.)

68222 Calculation of the infrared spectra of hydrogenated and fluorinated amorphous Si. E.Martinez, F.Yndurain (Dept. de Fisica Fundamental, Univ. Autonoma de Madrid, Madrid, Spain).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.935-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The infrared absorption of a-Si:H is calculated. It is found that the extra-mode at 214 cm^{-1} which is observed in the infrared spectra of a-Si:H, F is due to the presence of internal small (~7 atoms) surfaces in the material associated with voids in the samples. The authors characterize the mode by the calculation of the correlation functions relating the motion of the atoms. The infrared activity of the mode is discussed in detail. (10 refs.)

68223 Investigation of large molecular fragments in glassy $Ge_{1-x}(Se, or S)_x$. K.Murase, T.Fukunaga, Y.Tanaka, K.Yakushiji, I.Yunoki (Dept. of Phys., Osaka Univ., Toyonaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.962-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
In order to see the medium range order in $Ge_{1-x}(Se, or S)_x$ glass, pressure as well as composition dependence of vibrational spectra is investigated. It is shown that Raman spectrum with perpendicular polarization in $Ge(Se, or S)_2$ is well reproduced by the density of states calculation for a relaxed large molecular fragment assuming 'outrigger raft'. The A_1 band shifts to the high energy side with increasing pressure. The pressure coefficient is very small at $x=2/3$. The Raman spectra due to Se chains show appreciable softening at high pressures. The characteristic spectra due to S_8 rings disappear at not more than 20 kbar. The glass containing tin atoms is found to be of great use to understand the structure of the chalcogenide glasses. (11 refs.)

68224 Observation of a Soret-Dufour effect for laser-generated carriers in germanium. J.S.Preston, H.M.van Driel (Dept. of Phys., Univ. of Toronto, Toronto, Canada).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.1021-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The absorption of high-intensity laser radiation in semiconductors can generate high carrier densities and temperatures. If the absorption coefficient is high, large lattice temperature gradients and, therefore, band-gap gradients are produced. Under certain conditions it is possible for temperature gradients and not density gradients to dominate the carrier diffusion process, with carrier confinement near the surface being possible. The authors present preliminary evidence of this effect based on 10.6 μm reflectivity probing of carriers generated by 0.53 and 1.06 μm excitation pulses in germanium. (7 refs.)

68225 Chalcogenides and pnictides of group VIII transition metals: far-infrared spectroscopic studies on compounds MX_2, MXY, and MY_2 with pyrite, marcasite, and arsenopyrite structure. H.D.Lutz, G.Schneider, G.Kliche (Lab. fur Anorganische Chem., Univ. Siegen, Siegen, Germany).
Phys. & Chem. Miner. (Germany), vol.9, no.3-4, p.109-14 (1983).
The far-infrared (FIR) spectra of pyrites, marcasites and loellingites, and arsenopyrites, of the type MX_2, MY_2 and MXY with M=Fe, Co, Ru, Rh, Os, Ir, X=S, Se, Te, and Y=P, As, and Sb have been studied. A group theoretical treatment has been made of the phonon modes. For the internal Y-Y and X-Y stretching modes, infrared (IR) spectra are obtained only in the case of arsenopyrites and lines are found in the ranges 440-490, 470-510, 450-490, 430-450 and 400-420 cm^{-1} for MP_2, MPS, MPSe, MAsS, and MSbS type compounds, respectively. From the obtained spectral intensities, weighted mean phonon frequencies, i.e. central frequencies as defined by Plendl (1961), and mass weighted ones have been calculated and interpreted in terms of the strength of the MX and MY bonds, particularly the 3d, 4d, and 5d transition metal compounds. The method of preparation and X-ray data of the chalcogenides and pnictides studied are also given. (21 refs.)

68226 Spin-flip Raman scattering, bound magnetic polaron, and fluctuations in (Cd,Mn)Se. D.Heiman (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA), P.A.Wolff, J.Warnock.
Phys. Rev. B (USA), vol.27, no.8, p.4848-60 (15 April 1983).
The spin-flip energy of donor-bound electrons is investigated in the semimagnetic semiconductor $Cd_{1-x}Mn_xSe$. Temperature and magnetic field dependences are measured with the use of Raman scattering and calculated theoretically from a statistical-mechanical model. Results of spin-flip Raman scattering are obtained for $x=0.01$ and 0.1 at temperatures from 1.5 to 30K and fields to 10 T. For $x=0.1$, and spin-flip energy is large (≤ 26 meV), giving g values approaching 200 at low temperatures. This enhancement is interpreted as an effective magnification of the field due to the exchange interaction between the carrier electron spin and the Mn^{2+} spins. The magnitude and temperature dependence of g are explained with the use of the mean-field approximation. At zero magnetic field and spin-flip energy is finite due to thermal fluctuations in the local magnetization and the bound magnetic polaron. These processes are incorporated in the theory which is used to derive simple formulas for the spin-flip energy and line shape. Good agreement is found between theory and experiment. The scattering strength and selection rules are also studied. The absolute cross section exceeds 10^{-20} cm^2/sr and is resonantly enhanced as the absorption edge is approached from lower energy. (20 refs.)

68227 Raman scattering in highly disordered amorphous phosphorus. R.J.Pomian, J.S.Lannin (Dept. of Phys., Pennsylvania State Univ., University Park, PA, USA), B.V.Shanabrook.
Phys. Rev. B (USA), vol.27, no.8, p.4887-94 (15 April 1983).
Raman scattering measurements are presented on amorphous phosphorus (*a*-P) films deposited by RF and DC sputtering under conditions that enhance structural disorder. This includes RF sputtering at increased substrate bias as well as DC sputtering employing in situ measurements on surfaces at 80K. In addition, the influence of annealing of the Raman spectra has been studied. The experimental results indicate that substantial changes in the Raman spectra occur relative to more ordered RF sputtered *a*-P films prepared at high pressure. These changes, which are most noticeable in low-temperature DC sputtered films, are interpreted in terms of modifications of both intermediate- as well as short-range order. The results indicate that modifications of intermediate-range order are primarily manifest by changes in the Raman coupling parameters, whereas the most disordered films indicate broadening of the phonon density of states as well. The influence of changes in short-range order on the polarized Raman spectra is related to dynamical correlation effects. (19 refs.)

68228 Far-infrared absorption of small-palladium-particle composites. P.Chylek (Dept. of Phys., Tufts Univ., Medford, MA, USA), D.Boice, R.G.Pinnick.
Phys. Rev. B (USA), vol.27, no.8, p.5107-9 (15 April 1983).
The authors use the recently derived size-distribution-dependent expression for the effective dielectric constant of a composite medium. Because of observed clustering of Pd particles they assume a broad size distribution for the small Pd particles embedded in KCl matrix. They obtain very good agreement between their theoretical calculation and experimental results. Values given by earlier theoretical calculations were by a factor of 10 below those supported by the measured data. (9 refs.)

68229 Comment on 'Role of atomic-scale roughness in surface-enhanced Raman scattering. A.Otto (Phys. Inst. III, Univ. Dusseldorf, Dusseldorf, Germany).
Phys. Rev. B (USA), vol.27, no.8, p.5132-6 (15 April 1983).
For original paper see ibid., vol.24, p.2289 (1981). The experiment recently reported by Wood is not in contradiction with considering atomic-scale roughness as playing an important role in the surface-enhanced Raman scattering process. (40 refs.)

68230 Reply to 'Comment on "Role of atomic-scale roughness in surface-enhanced Raman scattering"'. T.H.Wood (Crawford Hill Lab., Bell Labs., Holmdel, NJ, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5137-8 (15 April 1983).
For original paper see ibid., vol.24, p.2289 (1981), for comment see ibid. vol.27, p.5132 (1983). Otto argues that his original data can support the model for the importance of atomic-scale roughness (ASR) in surface-enhanced Raman scattering (SERS) if a process which he proposes for low-temperature film growth is used. This process is not supported by the resistivity data which he cites. Although several enhancement mechanisms probably do contribute to SERS, the conclusion of the original experiment, that enhancements due to ASR contribute less than 10^3 of the effect, remains valid. (8 refs.)

68231 Antimony(III) and bismuth(III) complexes of 2-amino-1,3,4-thiadiazole and 2-ethylamino-1,3,4-thiadiazole. A.C.Fabretti, G.Peyronel, A.Giusti (Istituto di Chimica Generale e Inorganica, Univ. di Modena, Modena, Italy).
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.311-13 (1983).
The following antimony(III) and bismuth(III) complexes of 2-amino-1,3,4-thiadiazole (atz) and 2-ethylmino-1,3,4-thiadiazole (eatz) have been prepared and study by IR and Raman spectroscopy: $SbCl_3$.2 atz, $SbBr_3$.1.5 atz, SbI_3.3 atz, $Sb(ClO_4)_3$.4 atz, $SbCl_3$.6 eatz, $SbBr_3$.eatz, SbI_3.1.66 eatz, $BiCl_3$.1.5 atz, $BiBr_3$.atz, BiI_3.1.75 atz, $Bi(ClO_4)_3$.5 atz, $BiCl_3$.3 eatz, $BiBr_3$.1.25 eatz, BiI_3.1.5 eatz. The ligands are bounded through the amine nitrogen atom with ν(MN) bands in the 530-400 cm^{-1} region. Part of the ClO_4^- ions are coordinated in the solid perchlorate complexes. (16 refs.)

68232 The role of C=O transition dipole-dipole coupling interaction in uracil. J.Bandekar, G.Zundel (Phys.-Chem. Inst., Univ. Munchen, Munchen, Germany).
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.337-41 (1983).
Theoretical arguments are presented, based on Davydov's excitation theory, for expecting the presence of coupling between C=O transition dipoles in uracil. In order to observe the effects of these coupling interactions, relevant experiments have been performed and their results discussed. The observed C=O band-splittings in uracil seem to be in support of such a coupling between various C=O dipoles within the unit cell of uracil. Since this transition dipole-dipole coupling interaction leads to band-splittings in the double-bond region, it is proposed that these splittings might provide a way to distinguish between different conformations in polynucleotides as well as in nucleic acids. (31 refs.)

68233 Normal coordinate analysis treatment on uracil in solid state. J.Bandekar, G.Zundel (Phys.-Chem. Inst., Univ. Munchen, Munchen, Germany).
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.343-55 (1983).
A normal coordinate analysis has been performed on the unit cell of uracil. Transition dipole-dipole coupling interaction between C=O groups within the four molecules in the unit cell was found necessary to explain the observed band splittings in the double-bond region. It has been proposed that this new interaction may be important in the authors' future attempts to distinguish between various conformations in polynucleotides and nucleic acids. Bands due to NH in-plane and out-of-plane bending modes were assigned by means of the spectra of uracil, 1-methyluracil and 3-methyluracil. Spectra of uracil and C_5-deuterouracil were made use of in assigning bands due to CH deformation modes. Bands due to C_2=O and C_4=O deformation modes were assigned by studying the spectra of uracil, 2-thiouracil and 2,4-dithiouracil. NH inplane bending mode bands have shown no indications of effects due to interactions through transition dipole-dipole coupling. NH out-of-plane bending mode bands have shown no indications of effects due to interactions through transition dipole-dipole coupling NH out-of-plane bending mode bands were found to be unusually sensitive to the strengths of hydrogen bonding. Normal mode calculations have shown a mixing of in-plane and out-of-plane bending modes below 1000 cm^{-1}. It is hoped that the calculations performed will provide the basis for future studies of polynucleotide as well as nucleic acid conformations by making use of the conformational sensitivity of the C=O stretching bands. (64 refs.)

68234 The temperature-dependence of the far-infrared spectra of L-alanine. J.Bandekar (Phys-Chem. Inst., Univ. Munchen, Germany), L.Genzel, F.Kremer, L.Santo.
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.357-66 (1983).
Far-IR spectra in the region 20-600 cm^{-1} are reported for solid L-alanine as a function of temperature between 6 and 300K. Understanding of the temperature-sensitive as well as the temperature-insensitive bands is aided by the normal coordinate analysis of L-alanine. Bands containing contributions from hydrogen bonds, skeletal deformation and $NH_3^{\$}+$ torsion are found to be highly sensitive to temperature changes. Although the hydrogen bonds are stronger at lower temperatures, no evidence of amide formation is detected even at 6K. Thus the zwitterion form seems to be more stable that the amide form in the temperature range studied. (52 refs.)

68235 Vibration spectra of 2-pyridinethione, 3-pyridazinethione and 2,4-dithiouracile. A.Lautie, J.Herbieu, J.Belloc (Lab. de Spectrochimie Infrarouge et Raman, CNRS, Thiais, France).
Spectrochim. Acta Part A (GB), vol.39A, no.4, p.367-72 (1983).
The IR and Raman spectra of polycrystalline 2-pyridinethione, 3-pyridazinethione, 2,4-dithiouracile and corresponding N-deuterated derivativies have been investigated in 400-40 cm^{-1} range. Solutions in various solvents were also examined. An assignment for all intramolecular fundamentals is given in apolar solvents. A metastable solid phase has now been shown-up for the deuterated 2,4-dithiouracile. In these compounds, the strength of NH...S hydrogen bonds are similar to NH...O interaction of corresponding 'oxo' molecules and characterised by νNH frequencies about 2900 cm^{-1}. (28 refs.)

68236 Competition among adsorbed species for surface sites on Ag electrodes as determined by SERS. J.F.Owen, T.T.Chen, R.K.Chang (Section of Appl. Phys., Yale Univ., New Haven, CT, USA), B.L.Laube.
Surf. Sci. (Netherlands), vol.125, no.3, p.679-98 (March 1983).
The surface enhanced Raman scattering intensity from halides (F^-, Cl^-, Br^-, and I^-), water, pyridine adsorbed on a Ag electrode has been measured as a function of electrode potential. Competition is evident among the adsorbed species for surface sites on the Ag electrode during the electrochemical oxidation-reduction cycle. Furthermore, the presence of pyridine in the electrolyte influences the adsorption of halides and water. (25 refs.)

68237 The adsorption of CO on Pt(111) studied by infrared reflection-adsorption spectroscopy. B.E.Hayden, A.M.Bradshaw (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Surf. Sci. (Netherlands), vol.125, no.3, p.787-802 (March 1983).
The interaction of CO with a clean Pt(111) surface at adsorption temperatures between 85 and 300K has been studied with infrared reflection-absorption spectroscopy (IRAS) as well as with TPD and LEED. In accordance with electron energy loss data, bands due to the C-O stretch are found in both the linear and bridging regions. The high resolution of IRAS shows, however, that there are two distinct bands in the bridging regions which can be assigned to CO in two-fold bridge and three-fold hollow sites. The results suggest a facile interconversion between the two species which is promoted by the occupation of excited states of the low frequency high-amplitude bending modes (frustrated translations). This accounts in turn for the increasing disorder observed with LEED at higher adsorption temperatures. For coverages above $\theta=0.5$, where a continuous splitting of the extra LEED features is observed, the relative intensities of bands in the bridging and linear regions favour the 'fault-line' description of Avery (1981) rather than the incommensurate layer model. (32 refs.)

68238 Ethylene on silver: development of surface enhanced Raman lines with exposure. I.Pockrand (Phys. Inst. III, Univ. Dusseldorf, Dusseldorf, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.192-6 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Adsorption of ethylene on silver films (T_s=120K) as a function of exposure has been studied by following the surface enhanced Raman (SER) signal of the symmetric scissors mode. Exposures as low as 10^{-3} L were easily detected demonstrating the very high sensitivity of SERS for this system. (21 refs.)

68239 Raman scattering spectra of K_2ZnCl_4. V.F.Katkov, V.N.Moiseenko, V.I.Pastukhov, S.A.Flerova (State Univ., Dnepropetrovsk, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1599-600 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2824-6 (Sept. 1982). [received: April 1983]
Homogeneous clear crystals of K_2ZnCl_4 were prepared by the Czochralski method. The samples studied were in the form of a right parallelopiped, 6×3×4 mm, with its edges parallel to the *a*, *b*, and *c* axes, respectively (for the $C_{2v}{}^9$ phase, $a\|P_s\|2_1$, where P_s is the spontaneous polarization). The Raman spectra and phonon frequencies of the ferroelectric phase of K_2ZnCl_4 were recorded at 300K in six scattering geometries, corresponding to the six nonzero independent components of the Raman scattering tensor for the C_{2V} group. (12 refs.)

68240 Experimental and theoretical study of Raman scattering in $Hg_2(Cl_xBr_{1-x})_2$ mixed crystals. C.Barta, G.F.Dobrzhanskii, G.M.Zinger, M.F.Limonov, Yu.F.Markov (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1672-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2952-62 (Oct. 1982). [received: April 1983]
Raman scattering was used to investigate the vibrational spectra of single crystals of mixed univalent mercury halides $Hg_2(Cl,Br)_2$. The experiments revealed optical vibrations with one, two, and three modes. The composition dependences of the frequencies were calculated by means of the model of cell-type uniform displacements, on the assumption that the $Hg_2(Cl,Br)_2$ mixed crystals consist of molecules of three types: Hg_2Cl_2, Hg_2ClBr, Hg_2Br_2. The classification of the solutions obtained was proposed and this allowed them to be correlated with the various observed types of behavior of optical vibrations in $Hg_2(Cl,Br)_2$. (13 refs.)

68241 Vibrational spectrum of barium nitrite hydrate $Ba(NO_2)_2.H_2O$ crystals. V.P.Gladkikh, G.F.Dobrzhanskii, A.A.Karamyan (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1727-9 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3051-5 (Oct. 1982). [received: April 1983]
Polarized Raman spectra of a $Ba(NO_2)_2.H_2O$ crystal in the temperature range 300-77K were investigated for the first time. A group-theory analysis of the vibrational spectrum was made and a specific symmetry was attributed to each observed line. Interesting features were observed in the region of internal vibrations of the nitrite group $NO_2{}^-$. It was found that the $Ba(NO_2)_2.H_2O$ lattice, with spatial symmetry $C_6{}^2$ or $C_6{}^3$, contains two sets of $NO_2{}^-$ ions in different positions. A considerable directional dispersion of the antisymmetric stretching vibration of the $NO_2{}^-$ ions was observed. (6 refs.)

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Light polarization by chains of highly dispersed Fe, Co, and Ni particles .... See Entry 68255

Optical absorption spectrum of thulium acetate in solution ...... See Entry 68257

The contribution of the Staebler-Wronski effect to gap-state absorption in hydrogenated amorphous silicon .... See Entry 68261

Structure of the short-wave edge of the lattice absorption band in zinc selenide doped with aluminum .... See Entry 68271

Action of ionizing radiation on the IR absorption spectra of NaF and LiF crystals .... See Entry 68273

Spectroscopic properties of transition elements in glasses of geological interest .... See Entry 68274

Fano resonances in sulfur, selenium and tellurium doped silicon .... See Entry 68276

Far-infrared magneto-dynamics of photoexcited electron system in gallium arsenide .... See Entry 68277

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Zeeman spectroscopy of cobalt doped InP .... See Entry 68279

Compensation mechanism in Ni-diffused n-type GaP [optical absorption spectra] .... See Entry 68280

Infrared spectroscopy of amorphous hydrogenated GaAs, GaP, GaSb, evidence for Ga-H-Ga bridges .... See Entry 68281

Additional structure in infrared excitation spectra of group-III acceptors in silicon .... See Entry 68282

Absorption spectrum of Cu^{2+} in strontium tartrate tetrahydrate .... See Entry 68284

Luminescence study of $LiGa_{5-x}Fe_xO_8$ .... See Entry 68298

Spectroscopic and laser properties of (Pr, La)P_5O_{14} and (Pr, Y)P_5O_{14} crystals .... See Entry 68300

Study on optical spectra of Cr^{3+} ions in phosphate, fluorophosphate and fluoride glasses .... See Entry 68302

Optical properties of codeposited aluminum-silicon composite films .... See Entry 68338

Hard carbon coatings with low optical absorption .... See Entry 68340

Polarized transmission and ATR studies of drawn polyethylene terephthalate films in the infrared .... See Entry 68343

Effect of preparation technique and temperature on optical properties of amorphous silicon films .... See Entry 68344

Optical four-wave mixing spectroscopy of PbSe epitaxial layers .... See Entry 68345

Vibrational spectra of defect and allow atom complexes in amorphous silicon films .... See Entry 68346

Infrared absorption spectra for B- and P-doped a-Si .... See Entry 68347

Disorder and optical properties in gallium arsenide .... See Entry 68348

Optical properties of CdTe thin films studied by photothermal deflection spectroscopy .... See Entry 68354

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition .... See Entry 68448

Growth of hydrogenated amorphous silicon due to controlled ion bombardment from a pure silane plasma .... See Entry 68461

Thermal evolution of alkali aluminosilicate gels .... See Entry 68500

Infrared study of trapped carbon dioxide in thermally treated apatites .... See Entry 68926

78.35 BRILLOUIN AND RAYLEIGH SCATTERING

68242 Comment on 'Light scattering study of the phase transition in sym-triazine' [and reply]. A.I.M.Rae (Dept. of Phys., Univ. of Birmingham, Birmingham, England), A.Yoshihara, E.R.Bernstein, J.C.Raich.
J. Chem. Phys. (USA), vol.78, no.7, p.4788-90 (1 April 1983).
Measurements of the Brillouin spectra from sym-triazine have been recently reported (ibid., vol.76, no.6, p.3218, 1982) and the results have been interpreted in the light of a theory of the phase transition which has been the subject of some discussion. The purpose of the comment is to point out that the light scattering results, as interpreted, are inconsistent with the results of previous experimental measurements and that some of the parameters obtained by fitting the results to the theory are not consistent with values determined previously. Yoshihara et al. reply to Rae's comment. (15 refs.)

68243 Influence of ionic strength on the diffusion of polystyrene latex spheres, bovine serum albumin, and polynucleosomes. K.S.Schmitz, Mei Lu, J.Gauntt (Dept. of Chem., Univ. of Missouri, Kansas City, MO, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5059-66 (15 April 1983).
Quasielastic light scattering methods were used to determine apparent diffusion coefficients (D_{app}) for polystyrene latex spheres, bovine serum albumin, and polynucleosomes under conditions of neutral *p*H and low ionic strength (0.1-50 mM). Data were collected at several time intervals (Δt) at each of several scattering angles (θ) in the range $35<\theta<120$ and analyzed by the asymptotic analysis method (D_{app} vs T, where $T=N\Delta t$ is the time window for the $N+1$ point autocorrelation function). These data suggest that the asymptotic limit $D_{app}(T\rightarrow 0)$ is independent of θ for the thre systems examined, whereas the asymptotic limit $D_{app}(T\rightarrow\infty)$ appears to be proportional to the reciprocal of the total light scattering intensity. These results are interpreted in terms of 'free' and 'temporal aggregate' domains within the polyelectrolyte solution. The critical size, hence stability, of the temporal aggregate is proposed to result from a balance between attractive forces arising from fluctuations in the small ion and polyion distributions and the disruptive Brownian forces. Under conditions of extremely low ionic strength, direct interactions between polyions tend to dominate as inferred from data in the literature. These observations suggest at least four regimes in the description of the ionic strength dependence of D_{app}. (40 refs.)

68244 Photon correlation spectroscopy of polystyrene as a function of temperature and pressure Carroll, P.J. Stevens, J.R. (Bell Labs., Murray Hill, NJ, USA). G.D.Patterson, P.J.Carroll, J.R.Stevens (Bell Labs., Murray Hill, NJ, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.605-11 (April 1983).
Photon correlation spectroscopy is employed to study the slowly relaxing density and anisotropy fluctuations in bulk atactic polystyrene as a function of temperature from 100 to 160°C and pressure from 1 to 1330 bar. The light-scattering relaxation function is well described by the empirical function $\phi(t)=\exp[-(t/\tau)^{\beta}]$, where for polystyrene $\beta=0.34$. The average relaxation time is determined at each temperature and pressure according to $\langle\tau\rangle=(\tau/\beta)\Gamma(1/\beta)$ where $\Gamma(x)$ is the gamma function. The data can be described by the empirical relation $\langle\tau\rangle=\langle\tau\rangle_0 \exp[(A+BP)/R(T-T_0)]$ where R is the gas constant and T_0 is the ideal glass transition temperature. The empirical constant A/R is in good agreement with that determined from the viscosity or the dielectric relaxation data (1934K). The empirical constant B can be interpreted as the activation volume for the fundamental unit involved in the relaxation and is found to be comparable to one styrene subunit (100 mL/mol). The quantity B appears to be a weak function of temperature. (14 refs.)

68245 Photon correlation spectroscopy of poly(methyl methacrylate) near the glass transition. G.D.Patterson, P.J.Carroll, J.R.Stevens (Bell Labs., Murray Hill, NJ, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.613-23 (April 1983).
Poly(methyl methacrylate) (PMMA) has been studied by photon correlation spectroscopy in the temperature range 120-150°C. The relaxation function for longitudinal density fluctuations were determined and analysed using the empirical function $\phi(t)=\exp[-(t/\tau)^{\beta}]$. The average relaxation times were calculated for each temperature and compared to mechanical and dielectric relaxation data. The agreement between the various techniques for the primary glass-rubber relaxation was good. The relaxation function observed by light scattering became increasingly broad as the temperature was lowered. This is similar to the results reported previously for poly(ethyl methacrylate) (PEMA). In fact, the light-scattering relaxation function is dominated by the secondary relaxations in these two polymers. Nevertheless, the average relaxation time $\langle\tau\rangle$ is dominated by the longest relaxation times associated with the primary glass-rubber relaxation. (27 refs.)

68246 Brillouin scattering observation of phonon scattering by inhomogeneities in phase separated glasses. J.Pelous, A.Essabouri, R.Vacher (Lab. de Spectrometrie Rayleigh-Brillouin, Univ. des Sci. & Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.549-51 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The authors have studied by Billouin scattering the attenuation and velocity of hypersonic waves in a glass formed by quenching an aqueous solution of LiCl (molar electrolyte content: 10%). This material has been used because the phase separation in this material can be easily controlled by heat treatments and detected by measuring the Rayleigh scattering intensity. The elastic properties appear to depend on heat treatment. The differences observed for various samples are independent of temperature and seems likely to be due to scattering of acoustic phonons by structural inhomogeneity. (4 refs.)

68247 **Light scattering by two dimensional electron systems.** A.Pinczuk, J.M.Worlock (Bell Telephone Labs., Holmdel, NJ, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.637-42 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Resonant inelastic light scattering studies of two dimensional electron systems at semiconductor interfaces are described. The emphasis of the discussion is on the results obtained in GaAs-(AlGa)As heterostructures. (46 refs.)

68248 **Brillouin scattering investigation of paraelectric KH_2PO_4 near the tricritical point.** R.W.Gammon (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), E.Courtens, W.B.Daniels.
Phys. Rev. B (USA), vol.27, no.7, p.4359-68 (1 April 1983).
A high-resolution Brillouin scattering study of the soft acoustic mode of KH_2PO_4 in the hydrostatic-pressure range 0-4 kbar is presented. All spectra could be fitted closely by the usual mean-field coupled-mode model. From those fits, the pressure dependence of the ferroelectric-mode relaxation rate is derived. At pressures near and above the tricritical point, the transition can be approached so closely that the Brillouin spectrum becomes strongly overdamped and very narrow (~50 MHz). Under those conditions, the elastic central peak of even the best available crystal becomes a dominant spectral feature, while the maximum dielectric constant is close to 10^6. (32 refs.)

68249 **High-resolution resonance Brillouin scattering and the effect of stress on GaAs.** R.Sooryakumar, P.E.Simmonds (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Phys. Rev. B (USA), vol.27, no.8, p.4978-85 (15 April 1983).
Five-pass Fabry-Perot interferometry is used to obtain the linewidths of exciton polaritons resonant Brillouin scattered in GaAs. Both interbranch and intrabranch peaks are measured. An interpretation of the results in terms of excitons with an energy-independent damping is shown to be inadequate for GaAs. The effect of uniaxial stress is investigated and discussed. Stress-induced splitting (greater than the longitudinal-transverse splitting of the exciton) of the degenerate valence band at the Γ point accounts for the observed decrease in the masses of the decoupled excitons. The values of these masses are in agreement with band-structure parameters. The value $\delta=0.0\pm0.02$ meV for the exciton exchange parameter has been determined from these data. (26 refs.)

68250 **Brillouin scattering in layered structures.** R.Hotz, J.K.Kruger, R.Siems (Fachbereich Phys., Univ. des Saarlandes, Saarbrucken, Germany).
Solid State Commun. (USA), vol.46, no.2, p.155-8 (April 1983).
Theoretical and experimental results on Brillouin scattering in inhomogeneous materials are presented: Normal elastic modes and Brillouin intensities have been calculated for a periodic layer system. Measurements on semicrystalline polybutene-1 are discussed in terms of the theoretical results. Both theory and experiment yield several Brillouin lines in *VV* scattering instead of the one peak characteristic for homogeneous specimens. (16 refs.)

68251 **Brillouin spectroscopy in $K_2Ba(NO_2)_4$.** Y.Luspin, G.Hauret (Lab. d'Etudes Phys. des Materiaux, Univ. d'Orleans, Orleans, France).
Solid State Commun. (USA), vol.46, no.5, p.397-400 (May 1983).
The temperature dependence of elastic stiffnesses of $K_2Ba(NO_2)_4$ is investigated in the range −140 to +160°C, in which two phase transitions have been reported. Marked anomalies appear at the lower transition, in contrast with continuous variations through the upper transition. Results are compared to those obtained near the upper transition by an ultrasonic method and they are qualitatively discussed. (9 refs.)

Molecular form factors and photon coherent scattering cross sections of water ....See Entry 64602

Resonance Rayleigh scattering of cyanine dyes in solution ......See Entry 65996

Stimulated Brillouin scattering of transversely polarized electromagnetic waves in magnetoactive moderately piezoelectric semiconductor plasmas ....See Entry 67672

Acoustooptic parameters of calcium molybdate crystals ....See Entry 68173

78.40 VISIBLE AND ULTRAVIOLET SPECTRA

68252 **Spectroscopic properties of nickel(II) ion in loaded mordenite.** E.D.Garbowski, C.Mirodatos, M.Primet, M.V.Mathieu (Inst. de Recherches sur la Catalyse, Villeurbanne, France).
J. Phys. Chem. (USA), vol.87, no.2, p.303-8 (20 Jan. 1983).
Ni(II) ions exchanged in sodium mordenite form highly asymmetrical complexes after dehydration, probably located in the specific catonic wall sites of the zeolite. These ions can coordinate CO or NO and give new carbonyl or nitrosyl complexes. The carbonyl complexes are reduced by hydrogen at room temperature into isolated nickel atoms whereas, in the case of nitrosyl complexes, NO groups shield nickel ions against reduction. In the absence of NO or CO ligands, the nickel ions are easily reduced into metal particles. This metallic phase can be completely reoxidized and redispersed by NO while O_2 reoxidation is only partial and requires higher temperatures. (30 refs.)

68253 **Optical absorption spectrum of PMMA via laser calorimetry.** P.Avakian, W.Y.Hsu, P.Meakin, H.L.Snyder (Central Res. & Dev. Dept., E.I. du Pont de Nemours & Co., Experimental Station, Wilmington, DE, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.647-55 (April 1983).
The optical absorption spectrum of poly(methyl methacrylate) (PMMA) has been obtained in the wavelength range 570-780 nm via laser calorimetry (employing a dye laser source). Because of the low thermal conductivity of PMMA, the complete solution to the heat conduction equation (carried out numerically) was required in the analysis of the data. At the wavelength of minimum absorption (near 647 nm), the absorption coefficient had the value 153 dB/km. (12 refs.)

68254 **Radiation and spectral characteristics of sapphire crystals produced by various methods.** A.L.Apanasenko, N.A.Kazakov, N.A.Kulagin, S.V.Landar', L.A.Litvinov, A.E.Ovechkin.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.808-13 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR),* vol.37, no.1, p.98-103 (July 1982). [received: March 1983]
Investigates the fundamental growth defects typical of the various growth techniques and the spectral characteristics of sapphire crystals over a wide range of wavelength. A comparative analysis is presented of the optical absorption, thermoconductivity, and thermoluminescence of leucosapphire produced by various techniques. (8 refs.)

68255 **Light polarization by chains of highly dispersed Fe, Co, and Ni particles.** M.A.Manaevskii, Yu.I.Petrov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.232-3 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR),* vol.53, no.3, p.392-4 (Sept. 1982). [received: May 1983]
To investigate the polarizing properties of Fe, Co, and Ni chains, pairs of identical samples were prepared. The samples were placed in Sf-26 or Specord-61 spectrophotometers in the path of the beam one after another, initially so that the chains in them were arranged mutually perpendicularly, then mutually parallel. The difference of the summed optical densities of the samples in the two positions, for the sake of brevity, is called dichroism (ΔD). The general regularities observed in the optical transmission spectra of Fe, Co, and Ni are the following: (1) ΔD monotonically decreases with an increase in λ from 350 to 1000 nm, and a further increase in λ practically does not change ΔD. (2) The greatest dichroism ΔD_{max} in the visible region of the spectrum is possessed by the samples obtained at an argon pressure $p\sim1$ Torr: $\Delta D_{max}\leq1$ Fe; $\Delta D_{max}\leq0.5$ for Co; and $\Delta D_{max}\leq0.1$ for Ni. Reduction of the argon pressure to 0.1 Torr leads to a decrease in ΔD_{max} of sometimes an order of magnitude. Increasing p to several Torr changes ΔD little. However, it considerably worsens the adhesion of the deposit. (3) Under identical conditions of preparation ΔD is greater for those samples having greater optical density. (4) Oxidation in air at a temperature of 200°C is accompanied by a decrease in D. (6 refs.)

68256 **Optical absorption of CdS:Nd crystals.** G.F.Dobrzhanskii, O.V.Fialkovskaya, L.I.Khirunenko, S.P.Smirnov (Inst. of Phys., Acad. of Sci., Kiev, Ukranian SSR).
Phys. Status Solidi b (Germany), vol.116, no.1, p.K31-4 (1 March 1983).
The authors study the optical absorption spectra of CdS crystals doped with neodymium ions. The spectra (5850 to 6050 Å) at T=4.2K consist of a group of closely spaced sharp lines due to transitions between the components of the ground $^4I_{9/2}$ and the excited $^2G_{7/2}(^4G_{5/2})$ states of trivalent Nd ions. The investigations were made every 5K. The broadening of the lines with temperature rise can be attributed to the increasing interaction with lattice phonons. The change of the intensity ratio of different lines may be due to the change with temperature of a number of Stark levels involved in the absorption. (8 refs.)

68257 **Optical absorption spectrum of thulium acetate in solution.** S.V.J.Lakshman, C.K.Jayasankar (Dept. of Phys., S.V. Univ., Tirupati, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.642-53 (Nov. 1982). [received: April 1983]
The partial derivatives for Tm^{3+} ion have been calculated in terms of Racah (E^k) parameters. Radiative transition probabilities for fluorescence levels $^3P_0$, $^1I_6$, $^1D_2$ and $^1G_4$ of Tm^{3+} in thulium acetate are estimated. (17 refs.)

68258 **Absorption spectrum of Cr^{3+} ion in $KAl(SO_4)_2.12H_2O$.** S.V.J.Lakshman, A.Sundar Jacob (Dept. of Phys., S.V. Univ., Tirupati, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.654-8 (Nov. 1982). [received: April 1983]
The optical absorption spectrum of Cr^{3+} ion in Potassium Aluminium Sulphate single crystal has been studied. The values of the crystal field and Racah parameters derived are as follows: $Dq=1735$ cm^{-1}; $B=695$ cm^{-1}; $C=3128$ cm^{-1}. (11 refs.)

68259 **Non linear optical transmission of CdSe.** P.Lavallard, P.H.Duong, T.Itoh (Groupe de Phys. des Solides, ENS, Univ. Paris 7, Paris, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.401-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
With a dye laser, the authors studied the optical transmission of a very thin CdSe crystal. At high excitation intensity, the exciton absorption line broadens and increases to such a degree that the transmitted intensity decreases when the incident light intensity is increased. They show that the scattering of polaritons on bound excitons is a catastrophic process which explains well the observed negative dynamical absorption coefficient. (5 refs.)

68260 **Theory of free-electron optical absorption in n-InSb.** P.Pfeffer, W.Zawadzki (Inst. of Phys., Polish Acad. of Sci., Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.425-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Theory of free-electron absorption in InSb-type narrow gap semiconductors is developed and used to describe experimental data for n-InSb. Electron-two-phonon interaction is shown to give negligible contribution to absorption, while plasmon generation is an important absorption mechanism. Good agreement between the theory and experiment is obtained for acoustic deformation potential C=−14.6 eV. (17 refs.)

68261 **The contribution of the Staebler-Wronski effect to gap-state absorption in hydrogenated amorphous silicon.** N.M.Amer, A.Skumanich (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA), W.B.Jackson.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.897-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The contribution of light-induced conductivity and luminescence changes to gap-state absorption in a-Si:H was directly measured by photothermal deflection spectroscopy. The authors show that sample illumination enhances gap-state absorption while annealing restores its magnitude to the original level. Furthermore, they find that doping further enhances this absorption while compensation results in the smallest observed effect. They determine the energy position of the affected states to be 1.2-1.3 eV below the conduction band and tentatively attribute the enhancement to Si dangling bonds created by breaking the Si-Si bonds. (10 refs.)

68262 **Modulation-spectroscopy study of the $Ga_{1-x}Al_xSb$ band structure.** C.Alibert, A.Joullie, A.M.Joullie (Equipe de Microoptoelectronique de Montpellier, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
Phys. Rev. B (USA), vol.27, no.8, p.4946-54 (15 April 1983).
The authors report a detailed study of the $Ga_{1-x}Al_xSb$ band structure over the entire composition range. They have determined the energies, as a function of temperature, at which the direct transitions $\Gamma_8{}^v\rightarrow\Gamma_6{}^c(E_0)$, $\Gamma_7{}^v\rightarrow\Gamma_6{}^c(E_0+\Delta_0)$, $L_{4,5}{}^v\rightarrow L_6{}^c(E_1)$, and $L_6{}^v\rightarrow L_6{}^c(E_1+\Delta_1)$ occur, and those at which the indirect transitions $\Gamma_8{}^v\rightarrow X_6{}^c(E_X)$ and $\Gamma_8{}^v\rightarrow L_6{}^c(E_L)$ occur. A simple physical model is proposed to explain the experimental values of the E_0, Δ_0, E_1, Δ_1 bowing parameters. A detailed comparison is made between their results and previously reported ones. (34 refs.)

68263 **Empirically derived formula for the energies of the first ultraviolet absorption maxima of 20 alkali-halide crystals.** T.O.Woodruff (Scuola Normale Superiore, Pisa, Italy).
Solid State Commun. (USA), vol.46, no.2, p.139-42 (April 1983).
Hilsch and Pohl noted long ago (1928-30) that the energy of the first ultraviolet absorption maximum in an alkali halide crystal is well approximated by the energy required to transfer an electron from the halide ion to the alkali ion. A more consistent treatment of the Madelung energy by Wolf and Herzfeld (1928) led to a modified form of the Hilsch-Pohl expression which, unfortunately, agreed less well with experiment. In the present work, the electron-transfer model was retained, but a more complete analysis led to a simple formula which is in excellent agreement with most of the present experimental data. That analysis, involving theoretical as well as empirical

considerations, is presented together with a detailed quantitative discussion of ways to choose the single adjustable constant determining the two parameters entering the formula. Two such choices were considered; the results of applying each to the twenty alkali halide crystals which can be made from Li, Na, K, Rb, Cs as cations and F, Cl, Br, I as anions are tabulated. With the more successful of the two methods, the data for six of the crystals are reproduced by the formula with an accuracy of one millihartree (0.037 eV) or better; for eleven of the other crystals, to within less than 0.4 eV. For the remaining three (NaF, CsCl and CsI), the error is less than 0.6 eV. The second of the two methods for adjusting the single constant led to a reasonable fit in all 20 cases (f.c.c. and s.c.). (8 refs.)

68264 Influence of temperature on the effects arising from the spatial dispersion of $CdGa_2S_4$ crystals. L.M.Suslikov, Z.P.Gad'mashi, V.Yu.Slivka (State Univ., Uzhgorod, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1262-4 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1955-8 (Nov. 1982). [received: April 1983]
The long-wavelength fundamental absorption edge of cadmium thiogallate ($CdGa_2S_4$) single crystals was investigated in the $E \| c$ and $e \perp c$ polarizations of the incident light at temperatures in the range 77-380K. The temperature-dependent manifestations of the spatial dispersion of the permittivity of these crystals were analyzed. The relationship between these manifestations and the thermal shifts of the energy levels Γ_3 and $\Gamma_2+\Gamma_4$ at the top of the valence band of cadmium thiogallate was considered. (17 refs.)

68265 Optical properties of $TlInS_2$ single crystals near the fundamental absorption edge. G.I.Abutalybov, S.G.Abdullaeva, N.M.Zeinalov (Radiation Res. Section, Acad. of Sci., Baku, Azerbaidzhan SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1348-9 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2086-8 (Nov. 1982). [received: April 1983]
Single crystals of $TlInS_2$, which belong to the class of chalcogenide semiconductors with the general formula $T1^+(In^{3+}S_2)^-$, were grown by us using the Bridgeman-Stockbarger method is evacuated quartz ampules with different shapes of the bottom of the ampule. The absorption spectra of $TlInS_2$ single crystals were investigated near the fundamental edge using a grating monochromator by a static method, as well as by the λ-modulation method. (8 refs.)

68266 Role of the excitonic intermediate resonance in two-photon spectroscopy of CdS crystals. R.Baltrameyunas, Yu.Vaitkus, V.Gavryushin (V. Kapsukas State Univ., Vil'nius, Lithuanian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1637-40 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2888-93 (Oct. 1982). [received: April 1983]
The spectral properties of two-photon absorption (TPA) in CdS single crystals have been studied under conditions which are free of the effects of accompanying incoherent nonlinear phenomena. Special attention was given to TPA spectra at short wavelengths where resonant features with peculiar polarization and temperature dependences were observed at low temperatures. It is shown that these features are explained by resonant amplification of the intrinsic TPA when one of the two absorbed photons enters into a resonance with an exciton-like state. (23 refs.)

Point defects and microstructural stability of glasses under irradiation .... See Entry 65437

Detection of platinum atoms in optical glasses by a light scattering method .... See Entry 66361

Studies on induced smectic phases. III. Fourier transform infrared and laser-Raman spectral differences between isotropic and induced smectic phase of binary mixtures of nematogens with contrasting dielectric anisotropies .... See Entry 66811

Formation, properties and structure of fluoroborate glasses .... See Entry 66875

Surface restoration of oxygen-implanted silicon .... See Entry 67024

Influence of lithium and sodium on radiation defect formation in a KDr crystal in the temperature region 4.2-300K .... See Entry 67046

Gamma irradiation induced photochemical reactions in V-doped borate glasses .... See Entry 67047

Decay of electronic excitations at pairs of charged Frenkel defects in KI .... See Entry 67051

The electrical and optical properties of sodium germanate glasses .... See Entry 67271

A study of the band structure of the $Co_{1-x}Cu_xCr_2S_4$ system of magnetic semiconductors by the diffuse reflection method .... See Entry 67449

Role of composition fluctuations in exciton spectroscopy of solid solutions of semiconductors .... See Entry 67476

Exciton polaritons in monoclinic zinc diphosphide .... See Entry 67482

Anomalous increase in the dielectric function of thin semiconducting films in contact with metals .... See Entry 67499

Electrical and optical properties of polythiophene prepared by electrochemical polymerization .... See Entry 67556

The relaxation of electron-phonon system in the halogen bridged quasi-one-dimensional mixed-valence crystal .... See Entry 67579

Energy dependence of the carrier mobility-lifetime product in hydrogenated amorphous silicon .... See Entry 67645

Absorption and photoconductivity of In_2Se_3 and Ga_2Te_3 .... See Entry 67684

Vacuum annealing effects in lithium niobate .... See Entry 68001

Absorption spectra of Ti^{3+} in titanite .... See Entry 68002

Intervalence excitations of a mixed-valence salt: NMR and optical absorption in molten $InCl_2$ .... See Entry 68058

Optical transitions in oriented polyacetylene .... See Entry 68159

The effect of charged additives on the mobility gap and thermal activation energy of $As_2Se_3Cu_x$ .... See Entry 68161

Time-resolved optical measurement of Si lattice temperature during nanosecond pulsed laser annealing .... See Entry 68162

Optical absorption from polarons in a model of polyacetylene .... See Entry 68163

Interference spectra of magnetic polaritons .... See Entry 68184

Raman and visible-ultraviolet spectra of polyhalide anions in molten I_2/KI-LiI, I_2/CsCl-LiCl, and I_2-ICl/CsCl-LiCl .... See Entry 68199

Light scattering by two dimensional electron systems .... See Entry 68247

Quasilocal states in indium-activated alkali-halide crystals .... See Entry 68272

Bromine cluster centers in irradiated doped KBr crystals .... See Entry 68275

Compensation mechanism in Ni-diffused n-type GaP [optical absorption spectra] .... See Entry 68280

Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals .... See Entry 68285

Luminescence of products of low-temperature pyrolysis of anthracene .... See Entry 68288

Spectroscopic and laser properties of (Pr, La)P_5O_{14} and (Pr, Y)P_5O_{14} crystals .... See Entry 68300

Luminescence quantum efficiency of Mn^{2+} states in ZnS as studied by photoacoustic spectroscopy .... See Entry 68301

Optical properties of codeposited aluminum-silicon composite films .... See Entry 68338

Hard carbon coatings with low optical absorption .... See Entry 68340

Effect of preparation technique and temperature on optical properties of amorphous silicon films .... See Entry 68344

Disorder and optical properties in gallium arsenide .... See Entry 68348

Some properties of reactively sputtered tin lead oxide films .... See Entry 68351

78.45 STIMULATED EMISSION

(see also 42.65C in nonlinear optics)

68267 Magnetically tunable stimulated emission with recombination radiation in (Cd,Mn)Se. D.Ehiman (Francis Bitter Nat. Magnet Lab., MIT, Cambridge, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.775-6 (1 May 1983).
Stimulated emission of near-band-gap radiation is observed in the semimagnetic semiconductor $Cd_{1-x}Mn_xSe$ $x=0.1$. Excitation was achieved by optical pumping just below the absorption edge. The photon energy of the recombination emission is a strong function of both magnetic field and temperature. With increasing field, the emission shifts to lower energy. The shift is primarily proportional to the Mn^{++} magnetization and at high fields at approximately 60 meV. The magnitude is in reasonable agreement with that expected from the exchange energies. (9 refs.)

68268 Generation of stimulated emission in a concentrated barium-erbium double-fluoride crystal. A.M.Tkachuk, M.V.Petrov, I.G.Podkolzina, T.S.Semenova.
Opt. & Spectrosc. (USA), vol.53, no.3, p.235-6 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.396-9 (Sept. 1982). [received: May 1983]
Reports on low-temperature lasing by concentrated $BaEr_2F_8$ crystals on the ${}^4S_{3/2} \rightarrow {}^4I_j$ ($j={}^9/_2, {}^{11}/_2, {}^{13}/_2$) transitions. The $BaEr_2F_8$ crystals were grown by the Czochralski method and are isostructured to the BaY_2F_8 crystal. The lasing wavelengths, the values of the pumping-energy thresholds, and the temperature and duration of the pumping pulse are given according to the data of Ivanova et al. (1981). The temperature dependence of the pumping-energy threshold for the lasing lines at 0.8538, 1.2312, and 1.7350 μm is shown. These lines correspond to transitions from the lower Stark component of the ${}^4S_{3/2}$ term to components of the Stark splitting of the ${}^4I_{13/2}$, ${}^4I_{11/2}$, and ${}^4I_{9/2}$ terms, respectively. During flash-lamp pumping of the $BaEr_2F_8$ crystal the energy threshold for all the lines depends strongly on the temperature. (11 refs.)

68269 The experimental and theoretical investigation of the hot hole population inversion and far IR radiation generation in p-Ge under $E \perp B$ fields. J.K.Pozela, E.V.Starikov, P.N.Shiktorov (Inst. of Semiconductor Phys., Acad. of Sci., Vilnius, USSR), L.E.Vorobjev, F.I.Osokin, V.E.Stafeev, V.N.Tulupenko.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.226-8 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The relative inversion of the distribution function of the light (l) holes with respect to the heavy (h) holes for the energy range corresponding to the direct optical transitions between l-h bands in p-Ge have been investigated in crossed electric and magnetic fields both experimentally and theoretically. The far infrared radiation ($\lambda=100$ μm) generation in p-Ge under T=10-80K was experimentally discovered. (8 refs.)

68270 Population inversion and far IR emission of hot holes in Ge in crossed electric and magnetic fields. A.P.Chebotarev (Lebedev Phys. Inst., Moscow, USSR), V.N.Murzin, S.A.Stoklitsky, Yu.L.Ivanov, Yu.B.Vasiliev, A.A.Andronov, M.D.Chernobrovtseva, V.I.Gavrilenko, V.A.Kozlov, Z.F.Krasilnik, L.S.Mazov, I.M.Nefedov, Yu.N.Nozdrin, V.N.Shastin.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.229-31 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The extensive investigations of hot holes population inversion and the possibility of FIR laser action in Ge in crossed electric E and magnetic H fields are given via observation of FIR luminescence and the Monte-Carlo simulation. It is demonstrated that the light-heavy hole intersubband inversion is sustained in doped samples providing the hole amplification coefficient up to ten percent per centimeter. (8 refs.)

Concerning the mechanism of laser generation, the thickness of the active layer, the effects of natural resonances and the nature of the M and P-bands in CdS emission spectra during excitation by a nitrogen laser .... See Entry 66284

78.50 IMPURITY AND DEFECT ABSORPTION IN SOLIDS

68271 Structure of the short-wave edge of the lattice absorption band in zinc selenide doped with aluminum. M.P.Kulakov (Inst. of Solid State Phys., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.749-52 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.895-8 (June 1982). [received: Feb. 1983]
A group of absorption bands related to doubled frequencies of local vibrations due to defects in the zinc selenide lattice that are associated with the presence of aluminum is observed in the $(500\text{-}800)\times10^2$ m^{-1} range. The contribution of this absorption mechanism near $\lambda=10.6\times10^{-6}$ m with respect to this order of magnitude does not exceed the multiphonon absorption by the lattice for $[Al]\leq10^{23}$ m^{-3}. (7 refs.)

68272 Quasilocal states in indium-activated alkali-halide crystals. V.P.Danilov, V.I.Zhekov, T.M.Murina, L.E.Nagli, A.M.Prokhorov (P.N. Lebedev Phys. Inst., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.231-3 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.187-9 (20 Sept. 1982). [received: April 1983]
Two-step spectroscopy is used to observe absorption from the lower excited state of In^+ ions in alkali-halide crystals. This absorption is attributed to the

presence of quasilocal states of the activator in the conduction band of the crystal. The positions of the quasilocal levels relative to the ground state are estimated. (10 refs.)

68273 **Action of ionizing radiation on the IR absorption spectra of NaF and LiF crystals.** L.F.Vorozheikina.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.828-30 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.122-5 (July 1982). [received: March 1983]
Crystals were γ irradiated to doses of 10^5-10^7 R. IR transmission spectra were measured using an IKS-29 spectrometer at room temperature. No changes in the IR transmission of LiF and NaF crystals resulted from γ irradiation up to a dose of 10^5 R. With an increase in the γ-irradiation dose, observation of the IR transmission spectrum of LiF crystals revealed a decrease in intensity, right up to complete extinction, of the band at 3720 cm^{-1} due to free OH$^-$ ions, and of bands in the region 3680-3570 cm^{-1} due to complexes of OH$^-$ with divalent cationic impurity. (13 refs.)

68274 **Spectroscopic properties of transition elements in glasses of geological interest.** G.Calas (Lab. de Mineralogie-Cristallographie, CNRS, Univ. de Paris, Paris, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.311-14 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Geochemical behaviour of transition metal ions can be partly explained at the light of their crystallochemical properties in silicate melts. Different kinds of elements can be distinguished, when studying the dependence of spectral properties on glass bulk composition, stable complex formation and exotic valencies. (4 refs.)

68275 **Bromine cluster centers in irradiated doped KBr crystals.** A.K.Kauletbekova, R.I.Gindina, A.A.Elango.
Opt. & Spectrosc. (USA), vol.53, no.3, p.323-4 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.548-9 (Sept. 1982). [received: May 1983]
When KBr is irradiated at temperatures above 200K, the formation of Br_3^- centers is accompanied by the formation of some larger halogen clusters, which absorb in the 5.0-6.0-eV region. In KBr with Li, Na, Sr, and Ca impurities—in contrast with pure KBr, in which the bands which appear are broad and diffuse—the authors observed some intense bands with a peak near 5.5 eV and a halfwidth of 0.5 eV, which remained thermally stable up to 400K. Since *I* centers and defects that include *I* centers absorb along with halogen clusters in this part of the spectrum in bromides, it is not possible to interpret unambiguously the 5.5-eV band on the sole nature of its spectral position. The authors accordingly studied the properties of the centers responsible for the 5.5-eV band in doped KBr. The properties agree well with the interpretation that the bands at 5.5 eV result from formation of clusters of bromine. This agreement indicates that the Br_e^- and the 5.5-eV centers are made of the same material, and the dependence of the irradiation temperature implies that the degree of association of the halogen is greater than for Br_3^-. (6 refs.)

68276 **Fano resonances in sulfur, selenium and tellurium doped silicon.** E.Janzen, R.Stedman, H.G.Grimmeiss (Dept. of Solid State Phys., Univ. of Lund, Lund, Sweden).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.125-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
There are structures above the ionization edge in sulfur, selenium or tellurium doped silicon, which can be interpreted as Fano resonances. The interacting processes are a no-phonon transition to the continuum and the transition to a bound excited state accompanied by emission of an intervalley phonon. The binding energies of the 1s(E) and 2s(A_1) states are determined. (7 refs.)

68277 **Far-infrared magneto-dynamics of photoexcited electron system in gallium arsenide.** T.Ohyama (Dept. of Phys., Osaka Univ., Osaka, Japan).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.131-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
First time-resolved far-infrared laser cyclotron resonance and impurity Zeeman absorption (84, 119, 172, 220 μm) in GaAs under intrinsic photoexcitation and electric field excitation expose various new features of the photoexcited conduction electrons as well as the photo-neutralized impurities at liquid helium temperatures. (8 refs.)

68278 **Derivative absorption spectroscopy of GaAs:Cr.** R.Braunstein (Phys. Dept., Univ. of California, Los Angeles, CA, USA), R.K.Kim, D.Matthews, M.Braunstein.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.163-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Infrared wavelength modulation measurements at 300K in the spectral range 0.5-1.4 eV on semi-insulating n and p-type Cr doped GaAs have revealed extensive fine structure with variations in absorption coefficient $\Delta K \sim 10^{-1}$-10^{-2} cm^{-1} out of a relatively smoothly varying background absorption of 1-2 cm^{-1}. These results can be interpreted in terms of transitions from (Cr^{3+}-Cr^{2+}) to the valence and conduction bands and excited states. (6 refs.)

68279 **Zeeman spectroscopy of cobalt doped InP.** M.S.Skolnick (Royal Signals & Radar Establ., Great Malvern, England), Ch.Uihlein, H.Krath.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.170-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The 785.8 MeV crystal field $^4A_2(F)$-$^4T_1(F)$ transition of Co^{2+} in InP is studied in magnetic fields from 0 to 10 T. Clear C_{3V} axial symmetry is found and is attributed to a strong dynamic Jahn-Teller effect in the $^4T_1(F)$ excited state. A ground state g-value of 2.10±0.10 and excited state g-values of $g_\parallel = 0.96 \pm 0.05$, $g_\perp = 3.76 \pm 0.05$ are found. (10 refs.)

68280 **Compensation mechanism in Ni-diffused n-type GaP [optical absorption spectra].** J.M.Baranowski, M.Jezewski, Z.Liro (Inst. of Experimental Phys., Univ. of Warsaw, Warsaw, Poland).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.179-81 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Optical investigation of the diffusion profile of Ni acceptor in n-type GaP is presented. It is found that a single Ni impurity atom is responsible for compensation of 4 to 5 electrons from shallow donors. Generation of point defects, such as vacancies, by a dislocation climb mechanism is responsible for this large compensation. (10 refs.)

68281 **Infrared spectroscopy of amorphous hydrogenated GaAs, GaP, GaSb, evidence for Ga-H-Ga bridges.** Z.P.Wang, L.Ley, M.Gardona (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.968-70 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The infrared absorption spectra of hydrogenated amorphous GaAs show two prominent hydrogen related bands at 530 cm^{-1} and 1460 cm^{-1}. These bands are very broad and they amount to most of the hydrogen-induced infrared absorption. The remaining structures are a number of comparatively sharp lines due to Ga-H and As-H modes in partial agreement with earlier investigations. The authors argue that the broad bands arise from near-stretching (1460 cm^{-1}) and from wagging (530 cm^{-1}) vibrations of H atoms situated in bridging positions between two Ga atoms. This assignment is supported by similar bands in Al-H polymers, a-GaP:H, and a-GaSb:H. A model calculation of the mode frequencies is also presented. (5 refs.)

68282 **Additional structure in infrared excitation spectra of group-III acceptors in silicon.** D.W.Fischer, J.J.Rome (US Air Force Wright Aeronaut. Labs., Wright-Patterson Air Force Base, OH, USA).
Phys. Rev. B (USA), vol.27, no.8, p.4826-32 (15 April 1983).
High-resolution infrared $p_{3/2}$ and $p_{1/2}$ excitation spectra are reported for the group-III acceptors boron, aluminum, gallium, and indium in silicon. New lines, which are believed to be due to previously unresolved excited states, are observed in the $p_{3/2}$ spectra. A $5p'$ line is observed for the first time in the gallium spectrum. Some previously reported boron $p_{3/2}$ lines are relabeled to correspond with the other group-III spectra. A feature in each of the $p_{3/2}$ spectra is defined as E_1, the ground-state binding energy. Values measured for E_1 are 44.39, 69.03, 72.73, and 155.58 (±0.02) meV for B, Al, Ga, and In, respectively. The data show more complete correspondence between all the group-III excited-states lines than any previously published. The spin-orbit splitting of the valence bands is experimentally deduced to be 44.00±0.02 meV. (15 refs.)

68283 **Spin-polarization and spin-memory effects in the *F*-center absorption and *F′* conversion of NaI and NaBr crystals.** G.Baldacchini, G.P.Gallerano (Centro Ricerche Energia, Lab. Nazionali di Frascati del Comitato Nazionale, Frascati, Roma, Italy), U.M.Grassano, F.Luty.
Phys. Rev. B (USA), vol.27, no.8, p.5039-45 (15 April 1983).
The low-temperature optical conversion of *F* centers in NaBr and NaI into defects with absorptions at equal or higher energies was studied under magnetic fields up to 80 kG. A strong reduction of the optical conversion was observed under fields giving clear evidence that the reaction product of the conversion is an *F′* center with two electrons in a singlet state, the formation of which becomes forbidden in spin-polarized *F*-center systems. This magnetic field quenching of the *F′* conversion ('Porret-Luty effect'), however, is incomplete even under full spin polarization indicating the existence of some loss mechanisms. The clarify the latter, the authors measured the spin-memory loss during the optical cycle by monitoring the magnetic circular dichroism (MCD) under known pumping conditions, obtaining spin-mixing parameters of $\epsilon = 0.03$ and 0.12 for NaBr and NaI, respectively. These ϵ values can explain only in part the incompleteness of the magnetic field effect, hinting towards the existence of a bound triplet *F′* state. From the MCD measurement, the spin-lattice relaxation time of the *F* ground state as a function of magnetic field and the spin-orbit-splitting parameter Δ of the *F* center were determined too. (18 refs.)

68284 **Absorption spectrum of Cu^{2+} in strontium tartrate tetrahydrate.** V.Somasekhar, K.Purandar, Y.P.Reddy (Dept. of Phys., S.V. Univ., Tirupati, India).
Solid State Commun. (USA), vol.46, no.7, p.569-70 (May 1983).
The absorption spectrum of single crystals of Cu^{2+} in strontium tartrate tetrahydrate, grown from silica gel, is studied at laboratory and liquid nitrogen temperatures. From the analysis of the spectrum, the following crystal field parameters are evaluated; $Dq = 1000$ cm^{-1}, $Ds = 1535$ cm^{-1} and $Dt = 490$ cm^{-1}. (15 refs.)

68285 **Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals.** A.A.Lucas, S.E.Donnelly, J.P.Vigneron (Inst. for Res. in Interface Sci., FNDP, Namur, Belgium), J.C.Rife.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.66-79 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Reviews recent investigations and presents new results on the spectroscopic properties, in the vacuum ultraviolet, of composite materials made of metal containing inert gas bubbles of microscopic size. Three techniques have been used, namely Absorption, Electron Energy Loss and Fluorescence Spectroscopies to study thin film samples. Most of the data presented concern the helium/aluminum composite containing a few at.% of helium. The spectral range explored, between 5 and 30 eV, covers regions where spectral features are assignable either to the metal matrix or to the helium gas. Between 5 and 20 eV, EELS of thin He/Al films reveals, in addition to the usual Al bulk plasmons and Al/Al_2O_3 (boundary) plasmons of the metal film, two new loss continua, in the range 8.5 to 12.5 eV. The first band between 12.5 and 10.5 eV is assigned to spherical bubble plasmons. The assignment of a second, similar broad loss peak between 8.5 and 10.5 eV as being due to oxidized bubble plasmons is still tentative. Between 20 and 25 eV, Absorption Spectroscopy allows detection of the helium resonances line strongly broadened and shifted towards higher energies. The detailed line shape information, interpreted with the help of a theoretical model, gives access to the density and pressure state of the gas in the bubbles. (29 refs.)

Detection of platinum atoms in optical glasses by a light scattering method ....See Entry 66361

A study of X_3-center formation in KBr crystals by pulsed optical spectroscopy ....See Entry 66989

Surface restoration of oxygen-implanted silicon ....See Entry 67024

Influence of lithium and sodium on radiation defect formation in a KDr crystal in the temperature region 4.2-300K ....See Entry 67046

Gamma irradiation induced photochemical reactions in V-doped borate glasses ....See Entry 67047

Decay of electronic excitations at pairs of charged Frenkel defects in KI ....See Entry 67051

Correlation between electrical and vibrational properties of chlorinated and hydrogenated amorphous silicon prepared by glow discharge ...See Entry 67598

Energy dependence of the carrier mobility-lifetime product in hydrogenated amorphous silicon ....See Entry 67645

Cyclotron resonance and impurity absorption in tellurium under pressure in the submillimeter range ....See Entry 68029

Photochromic effect in alkali halide crystals doped with NO_3^- ions ....See Entry 68140

Nonlinear far-infrared magnetoabsorption and optically detected magnetoimpurity effect in *n*-GaAs .... See Entry 68179

Optical absorption of CdS:Nd crystals .... See Entry 68256

Luminescence study of $LiGa_{5-x}Fe_xO_8$ .... See Entry 68298

Luminescence quantum efficiency of Mn^{2+} states in ZnS as studied by photoacoustic spectroscopy .... See Entry 68301

Study on optical spectra of Cr^{3+} ions in phosphate, fluorophosphate and fluoride glasses .... See Entry 68302

Acoustoluminescence spectra of NaCl and KCl crystals .... See Entry 68336

Effect of preparation technique and temperature on optical properties of amorphous silicon films .... See Entry 68344

Vibrational spectra of defect and allow atom complexes in amorphous silicon films .... See Entry 68346

78.55 PHOTOLUMINESCENCE

68286 Fluorescence spectra and crystal field analysis of rare earth oxyhalides and oxysulfates doped with trivalent europium and terbium. J.Holsa (Dept. of Chem., Helsinki Univ. of Technol., Espoo, Finland).
Ann. Acad. Sci. Fenn. Ser. AII (Finland), no.196, p.1-58 (1983).
A crystal field analysis of Eu^{3+} doped RE oxyhalides, REOX:Eu^{3+}, (RE=Y, La and Gd; X=Cl, Br and I) and Tb^{3+} doped RE oxychlorides, REOCl:Tb^{3+} (RE=Y, La, and Gd), was conducted on the grounds of the corresponding fluorescence spectra. The sets of CF parameters calculated on the basis set of 49 $^7F_{JM}$ levels reproduce the experimental energy level schemes within RMS deviations of 4-8 cm^{-1}. The strength of the crystal field decreases with decreasing ionic size of the host cation and with increasing ionic size of the host anion. Similar results were obtained for the REOCl:Tb^{3+} series. The evolution of the CF parameter values from REOCl:Eu^{3+} to REOCl:Tb^{3+} is in agreement with the results of an electrostatic point charge calculation and may thus be used to predict the CF effect in other RE^{3+} ions in REOCl. The Racah parameters and the spin-orbit coupling constant were calculated from the REOCl:Eu^{3+} and REOBr:Eu^{3+} excitation spectra. A simultaneous free ion and CF simulation of the excited levels of Eu^{3+} ion using a strongly truncated set of $^{2S+1}L_{JM}$ levels gave poor results unless the free ion wavefunctions were well defined. A descending symmetry method was used to simulate the CF effect in RE oxysulfates doped with Eu^{3+} ions. (82 refs.)

68287 Study on the dependence of donor-acceptor luminescence of $(Zn_{0.85}Cd_{0.15})S$: Cu, Al phosphor on hydrostatic pressure using high-pressure microspectroscopic system. Guo Chang-xin, Zha Chang-sheng (Univ. of Sci. & Technol. of China, Hefei, China).
Acta Phys. Sin. (China), vol.32, no.1, p.139-44 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The dependences of luminescence peak shift and relative emission intensity of $(Zn_{0.85}Cd_{0.15})$ S:Cu, Al phosphor on hydrostatic pressure have been studied at room temperature with a high-pressure microspectroscopic system in conjunction with the gasketed diamond anvil cell, using the methanal ethanal mixture as pressure liquid, the hydrostatic pressure ranging 1 bar-66 kbar was monitored by ruby R-line shift. The emission peak $E(r)$ of $(Zn_{0.85}Cd_{0.15})$S:Cu, Al shift to higher energy with increasing pressure, $dE(r)/dP=4.7$ meV/kbar (38 cm^{-1}/kbar), but less strongly than does the absorption edge of the host. The relative emission intensity decreases strongly with increasing pressure, decreasing by 6% when pressure increasing from 1 bar to 66 kbar. The results can be explained in terms of Al^{3+}-Cu^{+} donor-acceptor pair model. Finally, the authors estimate that $dE_D(Al^{3+})/dP+dE_A(Cu^+)/dP=3.7$ meV/kbar (30 cm^{-1}/kbar). (9 refs.)

68288 Luminescence of products of low-temperature pyrolysis of anthracene. Kh.M.Gafurov.
Vysokomol. Soedin. Ser. B (USSR), vol.25, no.2, p.80-3 (1983). In Russian.
The method and results are given of an investigation of the absorption spectra on luminescence of paramagnetic fractions of the products of thermal treatment of anthracene. The results indicate that low-temperature pyrolysis of anthracine causes the formation of high-molecule homologues, existing in the form of binary radicals. (4 refs.) *A.J.B.*

68289 Optical orientation and exciton alignment in an HgI_2 crystal. R.I.Dzhioev, B.P.Zakharchenya, Yu.G.Kusraev, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.514-16 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.92-4 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
An experimental investigation has been carried out on the optical orientation and alignment of excitons in crystals of red mercury iodide. Tetragonal HgI_2 single crystals were grown from the gaseous phase and were not specially doped. The specimens were cooled down to liquid helium temperatures and were pumped by the krypton laser lines $\lambda=5208$ and 5309 Å along the c axis of the crystal. The emitted luminescence was recorded at a small angle to the c axis, using 'reflection' geometry. (6 refs.)

68290 Magnetic depolarization of hot photoluminescence in gallium arsenide crystals. D.N.Minlin, V.F.Sapega (A.F. Ioffe Physicotech. Inst., Acad. of Sci., USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.517-22 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.95-9 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
The polarization characteristics of hot photoluminescence (HPL) in p-GaAs were investigated. The HPL spectrum of p-GaAs at low temperatures is generated by transitions to the acceptor level by electrons pumping high into the conduction band (electron energy $\epsilon \gg kT$) from the band of heavy or light holes. Under exposure to linearly-polarized light, electrons in the conduction band are found to have an anisotropic momentum distribution. In strong enough magnetic fields H, the cyclotron motion of the electrons produces a rotation of the anisotropic part of the distribution function, provided the direction of H is not parallel to the symmetry axis of the electron momentum distribution. This effect gives rise to additional depolarization of HPL, which is reflected in the more rapid reduction of the linear polarization over the spectrum in a magnetic field. (9 refs.)

68291 Vibronic sidebands in ruby. U.Rothamel, J.Heber (Inst. fur Festkorperphys., Tech. Hochschule Darmstadt, Darmstadt, Germany), W.Grill.
Z. Phys. B (Germany), vol.50, no.4, p.297-304 (1983).
An experimental and group-theoretical study of single phonon vibronic sidebands of the *R*-lines in ruby has been performed. Restrictions in the electron-phonon-spectra due to crystal symmetry occur only in $E \| C$-polarization and for phonons with *k*-vectors zero or parallel to the *C*-axis. An analysis of the fluorescence and excitation spectra led to an identification of part of the lines in the vibronic sidebands with normal modes of the lattice. In the regime of acoustical phonons the intensity of the sideband increases with frequency following a potential law with an exponent of slightly less than 5. A strong enhancement of the vibronic transition probability was found on the high frequency side of the *R*-lines due to a resonance with the electronic transitions $^4A_2$-$^2T_1$. Cross-sections of the vibronic transitions in the spectral range of Stokes- and anti-Stokes-sidebands are given in a diagram. For acoustical phonons with energies up to 6 THz they are also expressed in a formula. (18 refs.)

68292 Photoluminescence of MgO. M.N.Bapat (Dept. of Phys., Univ. of Saugar, Sagar, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.984-5 (Dec. 1982). [received: April 1983]
A luminescence band peaking at 2.2 eV in case of MgO has been observed. The observed emission has been attributed to OH^- surface states and local excess of cations on the surface with similar states of coordination. (11 refs.)

68293 Electronic excited state transport and trapping in disordered systems: picosecond fluorescence mixing, transient grating, and probe pulse experiments. R.J.Dwayne Miller, M.Pierre, M.D.Fayer (Dept. of Chem., Stanford Univ., Stanford, CA, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5138-46 (15 April 1983).
A detailed experimental examination of the dynamics of energy transport and trapping in two component systems, using rhodamine 6 G (R6 G) as the donor and malachite green (MG) as the trap in both glycerol and ethanol solvents, is presented. The experiments were performed using fluorescence mixing and ground state recovery techniques providing temporal resolution of ~50 ps. Samples ranging from high trap-low donor concentrations (the Forster limit) to the opposite regime of high donor and low trap concentrations, were studied. These results were compared with no adjustable parameters to the recent theoretical work of Loring, Andersen, and Fayer (LAF) (1982). The excellent agreement between theory and experiment over the entire donor-trap concentration range confirms the theoretical results of LAF and yields a comprehensive description of excited-state dynamics in solution. A variety of dynamic properties are calculated using the LAF theory and the measured parameters associated with the R6 G-MG system. (30 refs.)

68294 Dynamics of fluorescence quenching in micellar systems [and reply]. P.P.Infelta, M.Gratzel (Inst. de Chimie Phys., Ecole Polytech. Federale, Lausanne, Switzerland).
J. Chem. Phys. (USA), vol.78, no.8, p.5280-2 (15 April 1983).
In M. Tachiya, (1974) Infelta et al. conceived a kinetic model which served to explain the unique features of fluorescence quenching events in organized assemblies, such as surfactant micelles. The validity of the kinetic equations obtained as well as subsequent modifications were verified by vast experimental studies such as intramicellar excimer formation, electron transfer, triplet-energy transfer, and triplet-triplet annihilation. Subsequent to the publication, another mathematical approach to the problem of luminescence quenching in micellar systems was elaborated by Tachiya (1975) which confirmed Infelta et al. initial result. In a more recent paper by the same author, (Tachiya (1982)) the accusation was raised that the earlier model, though yielding the correct final equation, contained an error in its derivation and for this reason 'was wrong'. Infelta et al. contend with Tachiya's assessment and show that his criticism is unfounded. Tachiya replies to Infelta et al.'s comment by pointing out that even though Infelta et al. obtained the same results, this coincidence does not indicate that their treatment was correct and that it contains logical errors. (9 refs.)

68295 On the nonradiative and radiative decay rates and a modified exponential energy gap law for 4*f*-4*f* transitions in rare-earth ions. J.M.F.Van Dijk, M.F.H.Shuurmans (Philips Res. Labs., Eindhoven, Netherlands).
J. Chem. Phys. (USA), vol.78, no.9, p.5317-23 (1 May 1983).
A modified exponential energy gap law for nonradiative decay has been derived for 4*f*-4*f* transitions where only a few phonons participate in the transition. Its preexponential factor varies by only a factor of 10 for different host materials and is purely electronic in nature. The modified law is the usual law (giving a factor of 10^5 variation) modified by using an energy gap which is effectively two (maximum) photon energies smaller than the energy difference between the initial and the final electronic state. A general relation between the radiative and nonradiative decay rates has been constructed. For 4*f*-4*f* transitions this relation enables one to predict the nonradiative decay rate from a knowledge of the radiative decay rate to within one order of magnitude accuracy. (28 refs.)

68296 Luminescence and energy transfer in Y_2O_3 co-doped with Bi^{3+} and Eu^{3+}. Su Qiang (Changchun Inst. of Appl. Chem., Chinese Acad. of Sci., Changchun, China), C.Barthou, J.P.Denis, F.Pelle, B.Blanzat.
J. Lumin. (Netherlands), vol.28, no.1, p.1-11 (March-April 1983).
The emission spectra and decay times of the Y_2O_3 co-doped with Bi^{3+} and Eu^{3+} have been investigated using site-selective excitation and time-resolved spectroscopy in the temperature range 8-296K. Evidence for an energy transfer from $Eu^{3+}(S_6)$ to $Eu^{3+}(C_2)$ is given. The critical transfer distance $R_0=8.6$ Å was found from the decay curve. (11 refs.)

68297 The impurity-induced luminescence of $RbMnF_3$.
J. Lumin. (Netherlands), vol.28, no.1, p.27-39 (March-April 1983).
The impurity-induced luminescence of $RbMnF_3$ has been studied in the temperature range, 4-120K. Multimagnon sidebands of impurity-induced Mn^{2+} emission lines have been detected spanning the spectral range, 5515-5960 Å. The broad emission bands, which peak at 5750 Å and 6440 Å, have been attributed to phonon-assisted transitions from two impurity-induced Mn^{2+} traps of different depths. Pulsed luminescence measurements indicate that the quenching of the shallow trap emission is by a thermal activation to the El exciton level whereas the quenching of the deeper trap emission is by a multiple phonon decay. The coupling between Mn^{2+} ions is strong enough to support a detectable transfer of excitation between these two traps. The results of this research also include the observation in absorption of the El exciton line and its 1-magnon and possible 2-magnon sidebands. (15 refs.)

68298 Luminescence study of $LiGa_{5-x}Fe_xO_8$. C.McShera, P.J.Colleran, T.J.Glynn, G.F.Imbusch (Phys. Dept., Univ. College, Galway, Ireland), J.P.Remeika.
J. Lumin. (Netherlands), vol.28, no.1, p.41-52 (March-April 1983).
Absorption, excitation, and luminescence measurements are presented for $LiGa_{5-x}Fe_xO_8$ with concentrations *x* from 0.015 to 0.26. The emission and excitation data indicate that the red luminescence observed is due to the $^6A_1(^6S)\leftarrow{}^4T_1(^4G)$ transition in the d^5 configuration for Fe^{3+} in tetrahedral sites. Single-crystal samples allow direct absorption measurements for the first time and these indicate that most of the Fe^{3+} substitutes for Ga^{3+} in octahedral sites. Fine structure in the zero-phonon line and in the sideband is reported. (18 refs.)

68299 Excitation and temperature dependence of the excitonic emissions in undoped and Mg-doped VPE InP. G.S.Pomrenke, Y.S.Park (Avionics Lab., AFWAL/AADR, Wright-Patterson AFB, OH, USA).

J. Lumin. (Netherlands), vol.28, no.1, p.53-63 (March-April 1983).

The photoluminescence of vapor phase epitaxial indium phosphide, both unimplanted and magnesium implanted, is investigated as a function of excitation intensity and temperature to gain a more complete understanding of the free exciton, exciton-bound donor, exciton-bound acceptor (residual and Mg), the 1.4155 eV emission identified with both the recombination of free holes with neutral donors and with bound excitons to ionized donors, and the recently identified 1.4122 eV emission (unique to Mg implanted layers). Emission peak broadening, quenching, and saturation is examined as the irradiance is varied from 0.002 to 33.3 W/cm^2 and the temperature from 2.6 to 50K. The source of the 1.4122 eV emission is speculated to be a donor-acceptor recombination involving a donor center bond to an off-axis band and the Mg acceptor, or more likely, excitons bound to point defects which are created by the acceptor implant. (18 refs.)

68300 Spectroscopic and laser properties of (Pr, La)P_5O_{14} and (Pr, Y)P_5O_{14} crystals. M.Szymanski (Quantum Electronics Lab., Inst. of Phys., A. Mickiewicz Univ., Poznan, Poland).

J. Lumin. (Netherlands), vol.28, no.1, p.87-110 (March-April 1983).

Systematic emission and absorption spectroscopic studies of $Pr_xLa_{1-x}P_5O_{14}$ (for x=1, 0.9, 0.8, 0.7, 0.5, 0.1) and $Pr_xY_{1-x}P_5O_{14}$ (for x=0.75 and 0.5) were performed at 300 and 77K. The structure of Pr^{3+} energetic levels in pentaphosphates was determined for each concentration considered. Numerical values of the most important spectroscopic parameters—the emission cross section, fluorescence quantum yield and branching ratio—determining the laser properties of the compounds investigated, were evaluated. Also, the radiative lifetime and normalized quenching rate values were obtained. (22 refs.)

68301 Luminescence quantum efficiency of Mn^{2+} states in ZnS as studied by photoacoustic spectroscopy. Y.Ohba, M.Mizuta, H.Kukimoto (Imaging Sci. & Engng. Lab., Tokyo Inst. of Technol., Yokohama, Japan).

J. Lumin. (Netherlands), vol.28, no.1, p.111-18 (March-April 1983).

Photoacoustic spectroscopy is employed to determine the luminescence quantum efficiency of Mn^{2+} in ZnS. Three spectra, photoacoustic spectrum, luminescence excitation spectrum and absorption spectrum, are compared. It is observed that the photoacoustic spectrum and the excitation behave complementarily. Radiative quantum efficiencies of the five excited states for Mn^{2+} have been determined. (10 refs.)

68302 Study on optical spectra of Cr^{3+} ions in phosphate, fluorophosphate and fluoride glasses. G.Fuxi, L.Huiming (Shanghai Inst. of Optics & Fine Mech., Acad. Sinica, Shanghai, China).

J. Phys. Colloq. (France), vol.43, no.C-9, p.303-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).

Absorption, fluorescence and lifetime measurements of Cr^{3+}, Mo^{3+} ions in three kinds of glass bases have been performed. Analysis and calculation of the spectral data based on the ligand field theory have been carried out. Furthermore, laser excited and time resolved emission spectra have been studied, spectral characteristics and site structure of Cr^{3+} ion in glasses are also discussed. (7 refs.)

68303 Luminescence of excitons bound by disorder-potential fluctuations in $CdS_{1-x}Se_x$: spatial diffusion, excitation level dependence, and kinetics. V.Agekyan (Inst. of Phys., A.A. Zdanov Univ., Leningrad, USSR), R.Bindemann, R.Schwabe, Yu.Stepanov, I.Streit.

Phys. Status Solidi b (Germany), vol.116, no.1, p.K43-6 (1 March 1983).

The emission spectrum of excitons in $CdS_{1-x}Se_x$ solid solutions has been investigated. The authors report some new features of excitons bound by disorder-potential fluctuations (DPBE) obtained from time-resolved luminescence measurements at different excitation levels. (4 refs.)

68304 Complex isotope splitting of the no-phonon lines associated with exciton decay at a four-lithium-atom isoelectronic centre in silicon. L.Canham, G.Davies, E.C.Lightowlers (Phys. Dept., King's Coll., London, England), G.W.Blackmore.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.119-21 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Isotope substitution studies and uniaxial stress measurements show that the optical centre responsible for the 1.045 eV luminescence system, produced in Li-doped Si by room temperature irradiation damage, may be identified with four Li atoms arranged in a C_{3v} molecular complex. (5 refs.)

68305 Radiative recombination of deep centers in ZnSe:In. E.A.Meneses, G.D.Meneses, P.Motisuke (Inst. de Fisica 'Gleb Wataghin', Univ. Estadual de Campinas, Campinas, Brazil).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.160-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The photoluminescence of In dopped ZnSe is studied under excitation with photon energy less and greater than the band gap energy. In the first case two emission bands A(1.098 eV) and B(2.015 eV) are observed and in the last case, three: A, B and C (2.233 eV). Based C should appear also in the first case since its transition energy is less than the excitation energy. The authors attribute the absence of the C line to the frequency dependence of the optical photoionization cross-section (OPCS) of the deep levels associated with the emission bands. In order to check this assumption they measured the photoluminescence excitation spectra at 77K. This gives the OPCS of the deep levels. The OPCS of band C is quite different from those of bands A and B. The latter are similar to each other and both are well explained by a theoretical model developed by Chantre et al. (1981). (8 refs.)

68306 Evidence for associated deep donor-shallow acceptor pair recombination for the EL2 emission band in GaAs. B.V.Shanabrook, P.B.Klein, S.G.Bishop (Naval Res. Lab., Washington, DC, USA).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.173-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Previous studies have suggested that the EL2 emission band in GaAs arises from an intracenter charge transfer in a complex composed of a deep donor level and its associated near-neighbor acceptor. In the present study, time-resolved photoluminescence measurements have been performed on the EL2 emission band. The position and width of the EL2 emission band are found to be independent of the time elapsed after the exciting laser pulse. This observation is in agreement with the previously mentioned donor-acceptor pair recombination model involving donors and acceptors with a well-defined spatial separation. The authors have also performed photoluminescence fatigue measurements on both the EL2 emission band and a related band at .68 eV. The implications of these measurements for the interpretation of the metastable electronic state of EL2 are discussed. (12 refs.)

68307 Deep level optical spectroscopy of the levels introduced by transition metals in GaAs. F.Litty, P.Leyral, S.Loualiche, A.Nouailhat, G.Guillot (Inst. Nat. des Sci. Appliquees de Lyon, Villeurbanne, France), M.Lannoo.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.182-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

3d transition metals introduce deep states in gaAs and act generally as acceptors. Results of different techniques are sometimes difficult to be bound. Luminescence properties (emission spectra, excitation spectra) of the levels introduced by Fe and V are presented in connection with their electrical characterization; Deep level optical spectroscopy gives the photoionization cross sections $\sigma_n{}^{\circ}$ and $\sigma_p{}^{\circ}$ of each level in the gap. Theoretical models are necessary to extract the physical data from $\sigma_n{}^{\circ}$ and $\sigma_p{}^{\circ}$. A new model is presented taking into account the symmetry of the electronic wave functions. (13 refs.)

68308 General trends in the luminescence properties of transition elements centres in III-V semiconducting compounds. V.S.Vavilov, V.V.Ushakov, A.A.Gippius (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.191-3 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The luminescence of impurity centres—transition elements of I, II and III series with electronic configuration d^{2-4}—has been studied systematically in III-V compounds. The change of properties of a given ion in various matrices (GaAs and GaP) is traced as well as variation in the features of optical transitions in a sequence of electronic configurations $3d^3$-$4d^3$-$5d^3$ (the charge state of impurity ions Me^{2+}). The radiative transitions are identified within the framework of crystal field theory using Tunabe-Sugano diagrams. The interaction of the transitions with phonons is studied. (4 refs.)

68309 Photoluminescence bands related to localized Mn^{2+} transitions in diluted magnetic semiconductors. M.M.Moriwaki, R.Y.Tao, R.R.Galazka, W.M.Becker (Dept. of Phys., Purdue Univ., West Lafayette, IN, USA), J.W.Richardson.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.467-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Photoluminescence excitation measurements have been carried out on the diluted magnetic semiconductors $Cd_{1-x}Mn_xTe$ and $Cd_{1-x}Mn_xSe$. The temperature dependence of the known 2.0 eV and 1.2 eV PL bands is discussed in terms of a configuration coordinate model involving Mn^{2+} intra-ion transitions. Two broad band emissions in $Cd_{1-x}Mn_xSe$, at 2.13 eV and 1.35 eV, are reported which appear to be the analogies to the PL bands seen in $Cd_{1-x}Mn_xTe$. (12 refs.)

68310 Transient, polarized modulated reflection spectroscopy of near bandedge excitations in $Cd_{.70}Mn_{.30}Te$. A.V.Nurmikko, S.Sugai, J.H.Harris (Div. of Engng., Brown Univ., Providence, RI, USA).

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.494-6 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Optically induced changes on subnanosecond timescale in the near normal incidence reflection spectra of semimagnetic $Cd_{1-x}Mn_xTe$ (x=.30) at zero magnetic field have been measured near its fundamental edge in the temperature range of 10 to 50K by sensitive picosecond excite-probe methods. Only part of these spectra show an observable dependence on the sense of circular polarization, but with a strongly temperature dependent decay rate and behavior suggestive of spin relaxation of localized, optically oriented electrons or holes. (9 refs.)

68311 Optical pumping in PbTe epitaxial films. B.Kaufmann, R.J.Nicholas, G.Bauer (Inst. fur Phys., Montanuniv. Leoben, Leoben, Austria), P.Vogl.

Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.505-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

Spin oriented electrons were generated in the many valley semiconductor PbTe by excitation with CO-laser radiation. For the PbTe band-structure, the initial polarization of the photoexcited carriers is calculated and for light propagating parallel to (111), P_i is found to be 0.72. The spectral dependence of the degree of polarization of the photoluminescence radiation was determined and a maximum value of about 10% was obtained. Using the Hanle effect, the 'spin'-relaxation time and the carrier life time were obtained. (12 refs.)

68312 Plasma deposited microcrystalline and amorphous silicon. A comparative study of photoluminescence. P.K.Bhat, G.Diprose, T.M.Searle, I.G.Austin (Dept. of Phys., Univ. of Sheffield, Sheffield, England), P.G.LeCouber, W.E.Spear.

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.917-19 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The photoluminescence (PL) properties of glow discharge μC-Si have been investigated. At low temperatures, the PL spectra show a weak 1.3 eV emission, probably associated with a residual amorphous phase, and a relatively dominant and narrow 0.9 eV band, which the authors attribute to the μC phase. A comparison with a-Si prepared by glow discharge and sputtering suggests that the width of the 0.9 eV defect emission is sensitive to the degree of disorder in these materials. (7 refs.)

68313 Efficient visible luminescence from hydrogenated amorphous silicon. D.J.Wolford, B.A.Scott, J.A.Reimer, J.A.Bradley (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA).

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.920-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The authors report on optical structural properties of a new class of efficient visible light emitting semiconductors; low-defect-density a-SiH_x alloys. Films are prepared by HOMOCVD from silane and RF plasma from disilane. Optical gaps increase monotonically with H incorporation and decreasing substrate temperatures (200-25°C), while spin densities remain low. New broadband luminescence develops in the alloy band tails and shifts to higher energies with the gap. At ~40% H, gaps reach 2.55 eV and yellow-orange PL peaks near 2.05 eV. Efficient PL persists at room temperature. Emission is attributed to band-tail excitons and phonon cooperation. (14 refs.)

68314 Picosecond radiative and nonradiative processes in As_2S_3 glass. B.A.Weinstein, T.E.Orlowski (Xerox Webster Res. Center, Rochester, NY, USA), W.H.Knox, T.M.Nordlund.

Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.977-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).

The build-up and decay of band-tail excited photoluminescence (PL) in As_2S_3 glass was measured over 0-300 ps using picosecond laser, jitterfree streak camera techniques. The maximum radiative rate is $\nu_1 \approx 4 \times 10^8$ Hz. Nonradiative processes competing with ν_1 exhibit a T^2-activated temperature dependence similar to the CW quantum efficiency. Different subsets of carriers appear to be involved in PL and photoinduced absorption. (15 refs.)

68315 Luminescence, transient transport and photoconductivity in chalcogenide glasses. K.L.Nagi (Naval Res. Lab., Washington, DC, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.980-2 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
A minimal set of states in chalcogenide glasses is proposed, which in conjunction with a fundamental mechanism can explain the totality of optical and transport data. (18 refs.)

68316 Soliton pair generation in polyacetylene: A lattice relaxation approach. Zhao-bin Su, Lu Yu (Inst. of Theoretical Phys., Acad. of Sinica, Beijing, China).
Phys. Rev. B (USA), vol.27, no.8, p.5199-202 (15 April 1983).
The theory of lattice relaxation and multiphonon process, developed by Huang and others, is generalized in this paper to consider both the radiative and nonradiative transitions between multielectron states, consistent with different symmetry-broken lattice configurations. The probability of the nonradiative decay of electron-hole pairs into soliton pairs and that of an electron (hole) into a polaron, as well as the cross section of soliton-pair photogeneration are calculated explicitly. The selection rules for both radiative and nonradiative transitions, and also the branching ratio of photoinduced neutral to charged solitons, are discussed. The theoretical results obtained are compared with numerical calculations and recent photoconductivity experiment. (16 refs.)

68317 Excimer emission in the isothermal luminescence of γ-irradiated hydrocarbon glasses at 77K. J.Mayer, Szadkowska-Nicze, I.Zuchowicz (Inst. of Appl. Radiation Chem., Tech. Univ., Lodz, Poland).
Radiat. Phys. & Chem. (GB), vol.21, no.4, p.401-3 (1983).
A new method of excimer generation, using the radiation technique, is described. Excimer emission was observed in the isothermal luminescence of hydrocarbon matrices doped with naphthalene, γ-irradiated at 77 K and after annealing at higher temperature. (11 refs.)

68318 Luminescence properties of the iron group ions in ionic crystals. F.Iova (Facultatea de Fizica, Univ. din Bucuresti, Bucuresti, Rumania).
Stud. & Cercet. Fiz. (Rumania), vol.34, no.10, p.927-44 (1982). In Rumanian.
The radiative emission processes and radiationless decay in localized luminescent centres in ionic crystals are reported. The concentration quenching and the temperature dependence of the emission for some particular ions (Cr^{3+}, Ni^{2+}, Mn^{2+}) are discussed. (29 refs.)

68319 Ortho- to para-exciton conversion in Cu_2O: a subnanosecond time-resolved photoluminescence study. J.S.Weiner, N.Caswell, P.Y.Yu (Dept. of Phys., Univ. of California, Berkeley, CA, USA), A.Mysyrowicz.
Solid State Commun. (USA), vol.46, no.2, p.105-8 (April 1983).
The photoluminescence spectra of Cu_2O have been studied as a function of time and temperature. At $T \sim 2.5K$ it was found that the 1s yellow ortho-excitons decay into para-excitons at the rate of $\gtrsim 2.5 \times 10^8$ sec^{-1} while the para-exciton lifetime is much longer and dominated by recombination at defects. As T is raised the rate of conversion of ortho-excitons into para-excitons increases approximately as $T^{3/2}$. None of the existing theories seem to explain this temperature dependence satisfactorily. (13 refs.)

68320 Decay scheme of 310 and 380 nm emission bands in NaCl:Pb system. R.Capelletti, U.Emiliani, J.Garcia Sole, M.Manfredi (Istituto di Fisica, Univ. di Parma, Parma, Italy).
Solid State Commun. (USA), vol.46, no.7, p.531-6 (May 1983).
Lifetime measurements have been performed on 310 and 380 nm emission bands present in the $NaCl:Pb^{2+}$ system. The results reveal complicated behaviour in the 310 nm band, present in quenched samples, showing three slopes in the time decay spectra, while for the 380 nm band only one temperature dependent lifetime is present. Time resolved spectra at LNT and the behaviour of the emission bands intensity vs temperature are reported. The results are discussed on the basis of a configuration coordinate scheme. (16 refs.)

68321 Photoluminescence of cis- and trans-polyacetylene. K.Yoshino, S.Hayashi, Y.Inuishi, K.Hattori, Y.Watanabe (Faculty of Engng., Osaka Univ., Osaka, Japan).
Solid State Commun. (USA), vol.46, no.7, p.583-5 (May 1983).
The emission intensity in cis-$(CH)_x$ increases a little and the emission peak shifts a little to shorter wavelength with increasing temperature, which can be interpreted by the distribution of several emission centers in energy. Photoluminescence is also observed in trans-$(CH)_x$ at around 1.03 μm for the first time. (11 refs.)

68322 Influence of the state of the surface on the low-temperature luminescence spectra of strongly excited ZnTe crystals. P.G.Lukashevich, V.A.Ivanov, M.A.Katibnikov (Inst. of Phys., Acad. of Sci., Minsk, Belorussian SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1285-7 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1992-5 (Nov. 1982). [received: April 1983]
The low-temperature luminescence spectra of strongly excited zinc telluride crystals were found to depend on the surface state. The exciton reflection spectra of some crystals had an additional maximum due to the presence of an exciton-free surface layer and the same crystals exhibited at $T \approx 6K$ a flattening of the photoluminescence spectra and the appearance of a luminescence band of a degenerate electron-hole plasma, associated with low values of the diffusion length of excitons near the semiconductor-vacuum interface. The luminescence spectra of those crystals whose spectra had a structure due to surface excitons exhibited a luminescence band associated with the pulling of excitons to the surface and their subsequent condensation into surface electron-hole drops. (17 refs.)

68323 Luminescence of epitaxial gallium arsenide heavily doped with silicon. V.F.Kovalenko, A.V.Prokhorovich (Inst. of Semiconductors, Acad. of Sci., Kiev, Ukranian, SSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1333-4 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2064-5 (Nov. 1982). [received: April 1983]
The authors investigated the luminescence of epitaxial heavily doped and compensated gallium arsenide, and observed a nontrivial dependence of the position of the photoluminescence maximum on the energy of the exciting photons. (4 refs.)

68324 Optical resonance cooling of the nuclear spin system in a semiconductor with an anisotropic *g* factor. Yu.G.Kusraev, E.S.Artemova, R.I.Dzhioev, B.P.Zakharchenya, I.A.Merkulov, V.G.Fleisher (A.F. Ioffe Physicotech. Inst., Acad. of Sci., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1533-5 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2705-8 (Sept. 1982). [received: April 1983]
Optical resonance cooling of the anisotropic spin system of ^{127}I nuclei in an HgI_2 crystal was studied with modulation of the circular polarization of the exciting radiation at NMR frequencies. Resonant changes in the magnetic depolarization were observed in the luminescence of an exciton bound to a neutral acceptor. The resonance frequencies correspond to the splittings of the Zeeman sublevels calculated for nuclei with a strong quadrupole interaction and an electric-field-gradient asymmetry parameter $\eta = 0.49 \pm 005$. (8 refs.)

68325 An investigation of the vibronic frequency distribution function in structurally disordered, solid materials by monochromatic luminescence excitation. O.K.Alimov, T.T.Basiev, Yu.K.Voron'ko (P.N. Lebedev Inst. of Phys., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1700-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3004-7 (Oct. 1982). [received: April 1983]
A method is presented for the spectral determination of vibronic frequencies in an activated medium by analysis of inhomogeneously broadend impurity luminescence spectra during selective laser excitation. (12 refs.)

68326 Luminescence of semiconductors containing charged dislocations. R.A.Vardanyan, G.G.Kirakosyan (Inst. of Solid-State Phys., Acad. of Sci., Chernogolovka, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1709-12 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3020-5 (Oct. 1982). [received: April 1983]
The polarization dependence of the luminescence generated in a semiconductor containing charged dislocations is obtained. The electron-phonon interaction which governs the dependences of the spectrum on the temperature and deformation potential constant is treated by the adiabatic method in the Franck-Condon approximation. (7 refs.)

68327 Impact ionization of exciton states and the Stark effect in pure CdS crystals. M.V.Lebedev, V.G.Lysenko (Inst. of Solid State Phys., Acad. of Sci., Chernogolovka, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1721-3 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3040-4 (Oct. 1982). [received: April 1983]
Extinguishing of exciton and exciton-impurity complex luminescence has been studied under passage of an electric current through crystals of CdS at helium temperatures and electric fields up to 2 kV/cm; the influence of the Stark effect on energy levels of a free exciton has also been demonstrated. Extinguishing of luminescence is explained by impact ionization of free and bound excitons by free carriers. It has been shown that field ionization under experimental conditions is not significant. (7 refs.)

68328 Photoluminescence of epitaxial films of ZnSe on GaAs. G.T.Vilisov, V.V.Nuvar'eva, P.E.Ramazanov (V.D. Kuznetsov Physicotech. Inst., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.618-20 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.42-5 (July 1982). [received: May 1983]
A study is made of the photoluminescence of epitaxial films of ZnSe on GaAs grown by the gas-transport technique in a flow of hydrogen at various epitaxy temperatures and times. Excitation is by ultraviolet light with $\lambda_{ex} = 365$ nm. The photoluminescence spectra of films grown on GaAs and quartz are compared. It is shown that the position of the photoluminescence bands depends on the temperature and duration of growth and also on the degree of crystalline perfection of the ZnSe films. The temperature quenching of the 710-nm (1.7 eV) and 560-nm (2.2 eV) bands indicates that each has two activation energies, suggesting that these bands are donor-acceptor in nature. (8 refs.)

Shift of emission band upon excitation at the long-wavelength absorption edge. Time-dependent fluorescence shift of a fluid ethanol solution of 6-methoxyquinoline .... See Entry 66041

Photochemistry of benzophenone in micelles. Phosphorescence emission from aromatic ketones in micellar solution .... See Entry 66043

Photophysical properties of benzimidazole and thiabendazole and their homologues. Effect of substituents and solvent on the nature of the transition .... See Entry 66048

Application of the energy gap law to nonradiative, excited-state decay .... See Entry 66054

Solvent motion controls the rate of intramolecular electron transfer in solution .... See Entry 66121

Theoretical and experimental investigation of electronically excited states, luminescence properties, and lasing capability of pyrene and its phenylethynyl derivatives .... See Entry 66266

Concerning the mechanism of laser generation, the thickness of the active layer, the effects of natural resonances and the nature of the M and P-bands in CdS emission spectra during excitation by a nitrogen laser .... See Entry 66284

Structural study of aluminium fluoroberyllate glasses .... See Entry 66876

Investigations of glass structure using fluorescence line narrowing and molecular dynamics simulations .... See Entry 66884

Vacancy defects in GaAs:Sn .... See Entry 66985

Measurements of dispersive phonon transport in gallium phosphide .... See Entry 67127

Doping mechanism and properties of Zn-doped GaN-epitaxial layers .... See Entry 67381

Effects of MBE growth conditions on carbon contamination in GaAs .... See Entry 67406

Triplet exciton lifetime under pressure in 'pure anthracene' .... See Entry 67459

Bound and free exciton states in InP .... See Entry 67463

Crystal field splitting of excitons bound to neutral complexes in GaP .... See Entry 67464

Instability of self-trapped exciton caused by hydrostatic pressure in AgCl .... See Entry 67465

Role of composition fluctuations in exciton spectroscopy of solid solutions of semiconductors .... See Entry 67476

Kinetics of polariton luminescence .... See Entry 67480

Exciton polaritons in monoclinic zinc diphosphide .... See Entry 67482

Plasmon excitation by Coulomb scattering of electrons in 2D systems .... See Entry 67494

Dissociation of (Zn,O) pairs in GaP .... See Entry 67517

Auger effect at localized impurities in semiconductors .... See Entry 67518

Transition metal impurities in InP: defect complexes and native defects .... See Entry 67520

Direct evidence for screening of carrier-acoustic phonon interaction at low to medium carrier densities in GaAs .... See Entry 67622

Theory of relaxation of hot electrons and oscillatory photoconductivity in polar semiconductors .... See Entry 67626

Energy band-gap shift with elastic strain in $Ga_xIn_{1-x}P$ epitaxial layers on (001) GaAs substrates .... See Entry 67812

Electron-hole recombination in As_2Se_3 .... See Entry 68085

Optical absorption spectrum of thulium acetate in solution ...... See Entry 68257

The contribution of the Staebler-Wronski effect to gap-state absorption in hydrogenated amorphous silicon .... See Entry 68261

Population inversion and far IR emission of hot holes in Ge in crossed electric and magnetic fields .... See Entry 68270

Spectroscopic properties of transition elements in glasses of geological interest .... See Entry 68274

Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals .... See Entry 68285

Electrical and photo-luminescence properties of ZnSe thin films grown by molecular beam epitaxy: substrate temperature effect .... See Entry 68440

Efficiency of luminescence in luminescent solar concentrators .... See Entry 68851

Fluorescent solar concentrators using liquid solutions .... See Entry 68853

78.60 OTHER LUMINESCENCE SPECTRA AND RADIATIVE RECOMBINATION

(for photoconduction and photovoltaic effects, see 72.40; for photoluminescence, see 78.55)

78.60F Electroluminescence

68329 Characteristics of switching electroluminescence of anthracene crystals. A.N.Makhotenko, V.Yu.Litvinenko.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.784-6 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.68-71 (July 1982). [received: March 1983]
Presents the basic characteristics of EL of anthracene accompanying switching: the emission spectrum under different levels of excitation (injection), current-brightness characteristics, and kinetics of EL and of the current. The spectral measurements were carried out in the stationary regime, while high-voltage rectangular voltage pulses with a duration of tens-hundreds of milliseconds with a repetition frequency of 2-20 Hz were used to study the kinetics. (5 refs.)

68330 Concerning the polarisation of radiation from electroluminescent films of ZnS-Mn in a Fabry-Perot resonator. N.A.Vlasenko, Yu.V.Kopytko, O.N.Koshel', V.S.Pekar.
Kvantovaya Elektron., Kiev (USSR), no.23, p.48-53 (1982). In Russian.
It is shown that at low excitation levels the polarisation characteristics of ZnS-Mn films agree well with the classical theory of a Fabry-Perot resonator taking into account the difference in reflection coefficients of the mirrors and the phase jumps for s- and p-polarisation. Losses in the electroluminescent layers, which determine the width of the interference bands, do not depend on polarisation. Changes in the polarisation characteristics at high excitation levels are discussed. (15 refs.)

Electrical properties of 6H-SiC *p-n* junctions with an epitaxial p^+-type Al-doped layer .... See Entry 67770

A study of emission lines from electrical trees .... See Entry 68124

78.60H Cathodoluminescence, ionoluminescence

68331 Characterization of luminescence centres in neodymium implanted zinc sulphide. F.J.Bryant, J.H.C.Hogg, P.R.Jaffery (Dept. of Phys., Univ. of Hull, Hull, England).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.595-600 (1983).
Analysis of the cathodoluminescence emission spectra of neodymium implanted cubic single crystal ZnS as a function of cost-implantation annealing temperature has enabled groups of emission lines to be identified as originating from transitions within particular luminescence centres. For each group of lines the wavelength separations yield energy splittings characteristic of the crystal field at the luminescence centre. Comparison of these splittings with values calculated by crystal field theory on the basis of a point charge model with due regard to possible sites of cubic symmetry in ZnS, has allowed two luminescence centres (*A* and *B*) to be identified. Centre *A*, which exists at low annealing temperatures, consists of a Nd^{3+} ion situated interstitially with 4 tetrahedrally disposed nearest neighbour S^{2-} ions. At higher annealing temperatures the emissions from centre *A* were found to decline giving way to those of centre *B*, which analysis shows to be a Nd^{3+} ion situated on a zinc substitutional site. (12 refs.)

68332 A donor-acceptor pair broad band emission in $AgGaS_2$. J.P.Leyris, J.P.Aicardi, S.Soule (Lab. de Phys. du Solide, Univ. de Perpignan, Perpignan, France).
J. Lumin. (Netherlands), vol.28, no.1, p.65-72 (March-April 1983).
The authors interpret a broad band emission of silver thiogallate ($AgGaS_2$) peaked at 1.642 eV with a width of 395 meV. They show that the recombination kinetics are governed by donor-acceptor processes, with the band shape dominated by vibronic interaction. A theoretical calculation of the time-resolved spectra built with the parameters of donor-acceptor transitions gives good agreement with the experimental spectra. (12 refs.)

68333 Cathodoluminescence of natural diamond associated with implanted impurities. V.S.Vavilov, A.A.Gippius, V.A.Dravin, A.M.Zaitsev, B.S.Zhakupbekov (P.N. Lebedev Phys. Inst., Acad. of Sci., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1288-90 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1996-2000 (Nov. 1982). [received: April 1983]
The cathodoluminescence spectra of natural diamond crystals doped by ion implantation exhibited for the first time some lines associated with luminescence centers containing Cr, Ni, Zn, Ag, and Tl. An analysis was made of the nature of these centers. A comparison of the cathodoluminescence spectra of diamond containing implanted Ni with the cathodoluminescence spectra of synthetic crystals showed that the luminescence of the latter was associated with Ni which was used as a catalyst during synthesis. (10 refs.)

Doping mechanism and properties of Zn-doped GaN-epitaxial layers .... See Entry 67381

Direct evidence for screening of carrier-acoustic phonon interaction at low to medium carrier densities in GaAs .... See Entry 67622

Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals .... See Entry 68285

78.60K Thermoluminescence

68334 Effects of pre-irradiation and quenching on the low-temperature thermoluminescence of KCl:Sr. M.Jimenez de Castro, J.L.Alvarez Rivas (Junta de Energia Nuclear, Madrid, Spain).
J. Phys. C (GB), vol.16, no.12, p.2375-80 (30 April 1983).
The effect of quenching from 650°C to room temperature as well as that of heavy predoses at room temperature on the thermoluminescence induced by X-irradiation at temperatures between 80 and 300K in KCl:Sr (80 ppm) samples have been investigated. These heavy predoses strongly reduce the glow peaks in the 170-300K range which are clearly related to interstitial centres involving impurity-vacancy dipoles. This result gives additional evidence to support the idea that such dipoles are also involved in the thermoluminescent processes operative above room temperature. The study of quenched samples has revealed the existence of a dipole aggregation process which is induced by irradiation. It is suggested that the energy transfer mechanism is the recombination of the radiation-induced interstitials and vacancies close to the dipoles, either during irradiation or in the thermoluminescence run. (10 refs.)

68335 Glow curves of thermally pre-treated NaCl:Ca crystals. K.N.Reddy, V.H.Babu (Phys. Dept., Osmania Univ., Hyderabad, India).
Radiat. Eff. Lett. (GB), vol.68, no.5, p.145-8 (1983).
Glow curves were recorded for NaCl:Ca crystals subjected to annealing and quenching from elevated temperatures. These specimens were irradiated with X-rays at room temperature using a tungsten target. Samples exhibit certain glow peaks which are observed only in the first thermal cycle. A marked difference in the glow curves pattern for the first and subsequent heating runs has been observed. It is suggested that these changes may be due to the change in the configurational coordinate system of F-centres due to the impurity existing in different states. (2 refs.)

Effect of Z_1 centres on the isothermal stability of colour centres in microcrystalline powder of KCl .... See Entry 66988

Radiation and spectral characteristics of sapphire crystals produced by various methods .... See Entry 68254

78.60M Sonoluminescence, triboluminescence

68336 Acoustoluminescence spectra of NaCl and KCl crystals. I.V.Ostrovskii, O.A.Korotchenkov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.228-9 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.387-9 (Sept. 1982). [received: May 1983]
The authors have determined the AL spectra of uncolored NaCl and KCl crystals in the visible region. It has also been shown that AL bands are observed in the regions of optical absorption by intrinsic defects of the color-center type. It can be concluded that the influence of electron-phonon interaction on the process of producing acoustoluminescence radiation, is appreciably weaker than on the photoluminescence of color centers. (5 refs.)

78.60P Chemiluminescence

(see also 82.40T Chemiluminescence and chemical laser kinetics)

68337 Thermodynamic treatment of chemiluminescence efficiency. Yu.P.Chukova.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.789-94 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.75-80 (July 1982). [received: March 1983]
A rigorous thermodynamic treatment is presented of the limiting efficiency of chemiluminescence. The reactions which require additional activation and the activationless chemiluminescent reactions are treated separately. (23 refs.)

78.65 OPTICAL PROPERTIES OF THIN FILMS

68338 Optical properties of codeposited aluminum-silicon composite films. G.A.Niklasson, H.G.Craighead (Bell Labs., Holmdel, NJ, USA).
Appl. Opt. (USA), vol.22, no.8, p.1237-40 (15 April 1983).
Aluminum-silicon composite films consisting of a mixture of aluminum and silicon particles were produced by electron-beam coevaporation. The reflectivity of samples with ≲33-vol.% Si was good agreement with the Bruggeman theory with no adjustable parameters. No parallel-band absorption peak due to the aluminum was detected analogously to the behaviour of microcrystalline aluminum films. (20 refs.)

68339 Substrate parameter determination for thin film spectrophotometric measurement correction. M.Matzeu, A.Panatta (Lab. delle Radiazioni, Istituto Superiore di Sanita, Roma, Italy).
Appl. Opt. (USA), vol.22, no.8, p.1247-50 (15 April 1983).
A method of obtaining accurate values for the optical parameters of thin film substrates is described. Calculations for reflected and transmitted fluxes in substrate sets are developed allowing for double reflection. A simple procedure to fit measurements is also illustrated. Values for substrate parameters are extracted and used to correct for substrate influence in thin film spectrophotometric measurements. Corrected thin film measurements and data calculated with obtained optical constants are compared. (5 refs.)

68340 Hard carbon coatings with low optical absorption. B.Dischler, A.Bubenzer, P.Koidl (Fraunhofer-Inst. fur Angewandte Festkorperphys., Freiburg, Germany).
Appl. Phys. Lett. (USA), vol.42, no.8, p.636-8 (15 April 1983).
Hydrogenated amorphous (*a*-C:H) films were prepared by RF-plasma deposition from benzene vapor. Complete optical absorption spectra from the UV to the IR (0.2-20.0 μm) have been measured. The optical gap depends linearly on hydrogen content and E_{opt} can be varied between 0.8 and 1.8 eV. For energies below E_{opt} the films are almost transparent and absorption is especially low in the 2-6-μm region (e.g. $\alpha = 15\ cm^{-1}$ at $\lambda = 2.8\ \mu m$). Sharp C-H stretch absorption bands occur near 3.4 μm, giving insight into the microstructure of the films. A newly reported weak band at 3.03 μm is first

evidence for C-C triple bonds (sp^1 hybridization) in *a*-C:H, where sp^3 (single) and sp^2 (double) C-C bonds dominate. (24 refs.)

68341 Microcrystal silicon film of 1.7 eV optical band gap. P.H.Fang, Peiguang Bai, C.C.Schubert, J.H.Kinnier (Dept. of Phys., Boston Coll., Chestnut Hill, MA, USA).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L149-50 (March 1983).
A prominent optical band gap of 1.7 eV has been observed in microcrystal silicon film prepared in vacuum at a substrate temperature of 625°C by electron beam evaporation. (6 refs.)

68342 Ellipsometric investigation of thin Permalloy films. K.Brudzewski, J.Mendyk, M.Zagorska, K.Conder (Inst. of General Chem. & Inorganic Technol., Warsaw Tech. Univ., Warszawa, Poland).
Electron Technol. (Poland), vol.13, no.1-2, p.111-16 (1980).
Recent developments in thin film magnetic bubble devices have renewed interest in precision measurements of the thickness of films. The authors present an application of the ellipsometric method for measurements of thickness (less than 40 nm) and optical parameters of permalloy thin films. The results of ellipsometrical measurements of Ni-Fe films show that optical constants are dependent on thickness. (8 refs.)

68343 Polarized transmission and ATR studies of drawn polyethylene terephthalate films in the infrared. U.D.Deshpande, G.Thyagarajan (Dept. of Phys., Indian Inst. of Technol., Bombay, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.846-8 (Oct. 1982). [received: April 1983]
Transmission and attenuated total reflection spectra are studied for drawn polethylene terephthalate films with unpolarized and polarized incident light. The films are stretched in definite stages. The dichroic ratios are calculated and the effect of drawing of polethylene terephthalate films on the dichroic ratios of different bands, is studied. The results indicate large variations for perpendicular and parallel bands. Assignments of the bands are more definite with this information. (6 refs.)

68344 Effect of preparation technique and temperature on optical properties of amorphous silicon films. J.M.Berger, B.Yous, J.P.Ferraton, A.Donnadieu (Lab. de Spectroscopie II, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.339-42 (Dec. 1982). In French. [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Optical properties of amorphous silicon films prepared by chemical vapor deposition, glow discharge and RF sputtering were determined from reflectance and transmittance measurements in the energy range 0.5 to 5.5 eV. The measurements were done at various temperatures T_m in the range 95 to 723K. Whatever the deposition technique when T_m becomes higher than T_s (substrate temperature) irreversible variations occur for both optical gap $E_g(T_m)$ and static refractive index $n_o(T_m)$. In the T_m range $n_o(T_m)$ varies linearly with $E_g(T_m)$; the slope of the straight line decreases linearly with hydrogen concentration. Whatever the deposition technique and the manner of incorporation of hydrogen in the Si matrix, hydrogen concentration seems to be the preponderant parameter between static refractive index and optical gap. (6 refs.)

68345 Optical four-wave mixing spectroscopy of PbSe epitaxial layers. H.Pascher (Phys. Inst., Univ. Wurzburg, Wurzburg, Germany), R.Grisar, G.Bauer.
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.398-400 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Optical four-wave mixing of the beams of two CO_2 lasers was used to observe spin-flip Raman transitions in PbSe epitaxial layers. By non resonant mixing of the laser beams in InSb, coherent radiation in the spectral range between the frequencies of the CO and CO_2 laser was generated. With this radiation and additionally some CO laser lines the authors measured in addition magnetooptical interband transitions in the samples. From the spin-flip and the interband data the PbSe bandparameters of the Mitchell and Wallis (1966) $\vec{k}.\vec{p}$ scheme were fitted. The results are in good agreement with cyclotron resonance data which were obtained by Fourier transform spectroscopy. (12 refs.)

68346 Vibrational spectra of defect and allow atom complexes in amorphous silicon films. G.Lucovsky, W.B.Pollard (Dept. of Phys., North Carolina State Univ., Raleigh, NC, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.865-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Provides a structural interpretation for the O-induced IR absorption bands in a-Si:H:O alloys. For films with C(0)~0.1 to 1.0 atomic % and C(H)~5 atomic %, there are three O-related IR features, at 2090 cm^{-1}, 980 cm^{-1} and 780 cm^{-1}. These are all assigned to the local atomic arrangement in which the H and O-atoms are bonded to a common Si-site. The mode at 780 cm^{-1} strongly couples Si-H and Si-O-Si motions and is a unique signature of a particular local geometry. The other two vibrations are decoupled Si-H (2090 cm^{-1}) and Si-O-Si (980 cm^{-1}) stretching motions whose frequencies are determined by near-neighbor induction effects. Substitution of D or F for H changes the degree and character of the coupling, whilst substitution of Cl removes it completely. (7 refs.)

68347 Infrared absorption spectra for B- and P-doped a-Si. S.C.Shen, Q.L.Jue (Shanghai Inst. of Tech. Phys. Acad. Sinica, Shanghai, China).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.868-70 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors have reported previously the intrinsic and the impurity induced spectra of B- and P-doped a-Si(H). They report here the effect of sample isochronal annealing on these spectra. Annealing at ~500C enables them to resolve some of the bands observed previously and thus to assign them to specific vibrational modes. The B-H stretching band, for instance, splits into two at 2475 and 2370 cm^{-1}. They are attributed to B-H_2 and B-H groups, respectively. The broad band of a-Si(H):B centered at 690 cm^{-1} splits into three at 830, 725 and 630 cm^{-1}. They are attributed to Si-B, B-H and Si-H modes. The 640 cm^{-1} band of a-Si(H):P splits into two at 630 and 670 cm^{-1}. They can be assigned to Si-H and P-H wagging modes, respectively. The effective charges of these various modes will be discussed. (12 refs.)

68348 Disorder and optical properties in gallium arsenide. C.Paparoditis, A.Rideau, G.Monnom, P.Gaucherel (Lab. de Phys. de la Matiere Condensee, Univ. de Nice, Nice, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.992-4 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Disorder in thin films of gallium arsenide obtained by molecular beam deposition has been investigated by means of optical spectroscopy above the fundamental gap and vibrational spectroscopy in the reststrahlen region. The gradual evolution from the crystalline to the amorphous state has been studied by following the evolution of reflectance and transmittance spectra in the region of the E_1, E'_0, E_2 transitions as well as TO and LO reflectance spectra. The spectral positions of these optical transitions in the UV range do not change with disorder but decrease selectively and persist for deposition temperatures as low as room temperature. Energy shifts in the LO and TO phonons are correlated with the microcrystalline structure and amorphous state. (6 refs.)

68349 Absorption in hydrogenated amorphous silicon at energies less than the optical band gap. V.S.Vavilov, A.G.Kazanskii, E.P.Milichevich (M.V. Lomonosov State Univ., Moscow, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1324-5 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.2051-3 (Nov. 1982). [received: April 1983]
The authors have investigated the spectral dependence of the absorption coefficient α in the range $h\nu<1.8$ eV by the constant photoresponse method. This method allowed them to find the dependence $\alpha(h\nu)$ by measuring the photoconductivity under conditions when the photocarrier lifetime was independent of the photon energy. In the range $h\nu>1.8$ eV the dependence $\alpha(h\nu)$ was deduced from the transmission spectra. These measurements were made at room temperature on *a*-Si:H films formed as a result of decomposition of a mixture of 4% monosilane with argon in a high-frequency glow discharge. (18 refs.)

68350 Reflection from thin metal films for λ~1 mm. E.A.Vinogradov, V.I.Golovanov, N.A.Irisova, A.B.Latyshev.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.8-11 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.11-15 (1982).
Measures the phases and amplitudes of reflection coefficients of thin metal films for λ~1 mm. The dependences of the reflection coefficients on the angle of incidence and the direction of polarization coincide with the theoretical relations obtained earlier by the impedance method. The impedances of the films obtained by independent reflection and transmission measurements, are equal and real. (2 refs.)

68351 Some properties of reactively sputtered tin lead oxide films. A.Czapla, J.Szczyrbowski, M.Jachimowski (Dept. of Solid State Phys., Inst. of Metall., Acad. of Mining & Metall., Krakow, Poland), H.Boudriot, B.Kubier.
Thin Solid Films (Switzerland), vol.102, no.2, p.123-30 (15 April 1983).
Reactive DC sputtering was used to produce thin oxide films of $Pb_xSn_{1-x}O_2$, where x was in the range from 0 to 0.6. The optical transmission and reflection spectra were measured at wavenumbers between 1.3×10^4 and 3.5×10^4 cm^{-1}. From these data the optical constants, surface roughnesses and thicknesses of films were derived. The results show that the optical constants depend on the composition of the source material used in sputtering. Measurements of the electron energy losses show that, in addition to the basic phase of $Pb_xSn_{1-x}O_2$, the films contain other phases of lead oxides as well as pure lead (for x different from zero). (12 refs.)

68352 An improved method for the determination of the extinction coefficient of thin film materials. J.P.Borgogno, B.Lazarides, P.Roche (Centre d'Etudes des Couches Minces, Domaine Univ. de St. Jerome, Marseille, France).
Thin Solid Films (Switzerland), vol.102, no.3, p.209-20 (22 April 1983).
The determination of the extinction of a material deposited in thim film form is generally made from Wolter's formula using $(R-R')T$. To avoid the measurement of R', we have derived an analogous formula involving only R and T in the term $(1-R-T)/T$. Moreover, this new expression can be used in oblique incidence. (6 refs.)

68353 Thickness dependence of the polar Kerr effect in thin ferromagnetic films. R.Carey, D.M.Newman, B.W.J.Thomas (Dept. of Appl. Phys., Coventry Polytech., Coventry, England).
Thin Solid Films (Switzerland), vol.102, no.3, p.245-9 (22 April 1983).
Using a general scattering matrix approach in the theoretical analysis, the polar Kerr rotation is shown to have a marked dependence on sample thickness when the thickness is less than 60 nm. The polar Kerr rotation is calculated for thin films of iron and cobalt for normal incidence in the wavelength range 400-1400 nm for both unbloomed and bloomed specimens. (12 refs.)

68354 Optical properties of CdTe thin films studied by photothermal deflection spectroscopy. J.G.Mendoza-Alvarez, B.S.H.Royce, F.Sanchez-Sinencio (Appl. Phys. & Materials Lab., Princeton Univ., Princeton, NJ, USA), O.Zelaya-Angel, C.Menezes, R.Triboulet.
Thin Solid Films (Switzerland), vol.102, no.3, p.259-63 (22 April 1983).
Photothermal deflection spectroscopy (PDS) was used to analyze CdTe thin films which are to be used to construct solar cells. CdTe thin films grown on a conducting SnO_2 layer deposited on glass show deviations from a stoichiometric composition due to an excess of tellurium. This nonstoichiometry modifies the absorption spectrum obtained from the PDS measurements. (13 refs.)

Optical bistability observed in amorphous semiconductor films .... See Entry 66325

The structure and the medium range order in thin amorphous germanium films prepared in UHV .... See Entry 66837

Structural order and optical properties of tetrahedral amorphous solids .... See Entry 66845

Doping mechanism and properties of Zn-doped GaN-epitaxial layers .... See Entry 67381

Amorphous to microcrystalline transitions in Si films .... See Entry 67403

Metal-induced crystallization of hydrogenated amorphous Si films .... See Entry 67404

Effects of MBE growth conditions on carbon contamination in GaAs .... See Entry 67406

Transparent conductive films of tin oxide-preparation and properties .... See Entry 67407

Anomalous increase in the dielectric function of thin semiconducting films in contact with metals .... See Entry 67499

Optical properties of deep centers in semi-insulating ZnSe .... See Entry 67539

Electrical and optical properties of polythiophene prepared by electrochemical polymerization .... See Entry 67556

Electrical properties of ion-implanted poly(*p*-phenylene sulfide) .... See Entry 67597

Correlation between electrical and vibrational properties of chlorinated and hydrogenated amorphous silicon prepared by glow discharge ... See Entry 67598

Amorphous silicon-carbon-fluorine alloy films .... See Entry 67689

Energy band-gap shift with elastic strain in $Ga_xIn_{1-x}P$ epitaxial layers on (001) GaAs substrates ...... See Entry 67812

Injection-stimulated blackening of As_2Se_3 films ...... See Entry 67823

Magnetic and magneto-optical properties of bismuth-substituted gadolinium iron garnet films ...... See Entry 67981

Spontaneous polarization of Langmuir multimolecular films ...... See Entry 68112

The optical constants of phases in cast aluminium alloys ...... See Entry 68156

Time-resolved optical measurement of Si lattice temperature during nanosecond pulsed laser annealing ...... See Entry 68162

Raman scattering in highly disordered amorphous phosphorus ...... See Entry 68227

Light scattering by two dimensional electron systems ...... See Entry 68247

Excitation and temperature dependence of the excitonic emissions in undoped and Mg-doped VPE InP ...... See Entry 68299

Optical pumping in PbTe epitaxial films ...... See Entry 68311

Plasma deposited microcrystalline and amorphous silicon. A comparative study of photoluminescence ...... See Entry 68312

Efficient visible luminescence from hydrogenated amorphous silicon ...... See Entry 68313

Luminescence of epitaxial gallium arsenide heavily doped with silicon ...... See Entry 68323

Photoluminescence of epitaxial films of ZnSe on GaAs ...... See Entry 68328

Concerning the polarisation of radiation from electroluminescent films of ZnS-Mn in a Fabry-Perot resonator ...... See Entry 68330

Electrical and photo-luminescence properties of ZnSe thin films grown by molecular beam epitaxy: substrate temperature effect ...... See Entry 68440

Transparent conducting layers, their preparation and utilisation ...... See Entry 68446

Laser induced deposition of zinc oxide ...... See Entry 68447

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition ...... See Entry 68448

Growth of hydrogenated amorphous silicon due to controlled ion bombardment from a pure silane plasma ...... See Entry 68461

78.70 OTHER INTERACTIONS OF MATTER WITH PARTICLES AND RADIATION

Electromagnetic radiation of relativistic channeling particles (the Kumakhov effect) ...... See Entry 67082

78.70B Positron annihilation

(see also 71.65 Positron states)

68355 The observation on o-P_s annihilation in silica aerogel by combined spectrometer. Zhang Tian-bao, Wang yung-Yu, Zhang Chang-chun (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.1-4 (Jan. 1983). In Chinese.
The yields and energy spectra of the various components of o-P_s annihilation in silica aerogel are observed using the combined spectrometer. It is shown that the processes of P_s formation and annihilation in ultrafine grains of SiO_2 aerogel are basically consistent with the diffusion model, but the grain surface effect can not be neglected. Comparing the Doppler broadening spectra, it is understood that the pick-off process of the longest component possesses a lower annihilation momentum than that of the free positron annihilation. (5 refs.)

Localization of electrons in Fe-Co alloys ...... See Entry 68100

About embrittlement process in amorphous metals ...... See Entry 68630

78.70C X-ray scattering

68356 X-ray Raman scattering on polycrystalline graphite in the scattering angle range 0-120°. Z.I.Kavogli, D.K.Leventouri, C.N.Koumelis (Phys. Lab., Univ. of Athens, Athens, Greece).
Can. J. Phys. (Canada), vol.61, no.4, p.629-32 (April 1983).
X-ray Raman scattering was studied on polycrystalline graphite for various scattering angles in the range 0-120°. A mosaic graphite spectrometer without collimators and CrKβ radiation were used. The shape of the Raman spectrum depended slightly on the scattering angle. The peak intensity of the Raman line increases with scattering angle but in a different way to that resulting from the calculation of Mizuno and Ohmura (1967). Additional components were observed in the spectrum on both sides of the Raman line. (14 refs.)

68357 Concentration dependence of the Huang scattering intensity of TaH_x alloys. H.Behr, H.Metzger, J.Peisl (Sektion Phys., Univ. Munchen, Munchen, Germany).
J. Phys. F (GB), vol.13, no.5, p.L75-6 (May 1983).
The analysis of the concentration dependence of the Huang diffuse scattering intensity from TaH_x single crystals has been re-evaluated using two quantities recently determined from independent measurements of the Bragg diffraction intensities. The authors now obtain good agreement between experiment and theory. (5 refs.)

68358 Role of intermediate layers in X-ray interference from thin films. V.A.Nachinov, L.G.Eliseenko, V.N.Dostovalov.
Opt. & Spectrosc. (USA), vol.53, no.3, p.321-2 (Sept. 1982). Translation of: *Opt. & Spektrosk. (USSR)*, vol.53, no.3, p.546-8 (Sept. 1982). [received: May 1983]
The presence of an interface inside the layer should affect the θ dependence of $\log[I(\theta)/I_0]$ (I/I_0 is the relative intensity of the beam resulting from specular reflection from the surface, I_0 is the intensity of the incident beam, and θ is the grazing angle). In an effort to determine how important this effect is, the author studied the specular reflection of $FeK_{\alpha 1}(\lambda=1.93597$ Å) radiation from thin aluminum films deposited by thermal evaporation in a $\sim 10^{-6}$-Torr vacuum on fused quartz surfaces that had been polished to an optical finish. The results indicate that interfaces—thin intermediate layers between layers of a homogeneous materal—play a governing role in the X-ray interference from multilayer structures. (9 refs.)

78.70D X-ray absorption and absorption edges

68359 Multiple-scattering effects in EXAFS spectroscopy of oxygen-bridge iron complexes. Possibility of angle determination by EXAFS analysis. Man Sung Co (Dept. of Chem. & Appl. Phys., Stanford Univ., Stanford, CA, USA), W.A.Hendrickson, K.O.Hodgson, S.Doniach.
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1144-50 (9 March 1983).
The Fe-Fe EXAFS in X-ray absorption data measured from a series of 12 oxygen-bridged iron complexes has been analyzed to investigate systematically the effect of intervening atoms on the structural information derived from EXAFS analysis. The series includes dihydroxo- or dialkoxo-bridge dimers and μ-oxo-bridged dimers and trimers. Three major pathways are considered for a photoelectron to travel to and from an absorber A to a scatterer C in a bridge A-B-C system. Pathway I is the direct backscattering from A to C and back. Pathway II is the multiple-scattering path via atom B in either the outgoing or the incoming trip. Pathway III is the multiple-scattering path via atom B in both outgoing and incoming trips. When the A-B-C (as exemplified by Fe-O-Fe) bridging angle is small, e.g. ca. 100°, the three pathways are solvable in the Fourier transform and can be analyzed independently. (23 refs.)

68360 An EXAFS investigation on the effect of cold rolling on copper. S.S.Fang, H.Chen (Dept. of Metall. & Mining Engng., Univ. of Illinois, Urbana, IL, USA).
J. Phys. & Chem. Solids (GB), vol.44, no.6, p.521-5 (1983).
An EXAFS study has been performed on annealed and cold-rolled copper foils in order to understand the structural change after deformation. Data taken from a cold-rolled specimen showed nearly identical nearest neighbour structure as compared with an annealed specimen. However, larger Debye-Waller factors and static displacements were observed for atoms in the higher coordination shells. Furthermore, increased disorder in the deformed specimen resulted in a reduced EXAFS amplitude. The determination of the electron mean free path and the effect of specimen non-uniformity on the transmission EXAFS amplitude are also discussed. (7 refs.)

68361 L_{III} X-ray absorption in the light rare earths: Ground-state versus final-state effects. S.Raaen, M.L.denBoer, V.Murgai, R.D.Parks (Dept. of Phys., Polytech. Inst. of New York, New York, NY, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5139-41 (15 April 1983).
X-ray L_{III} absorption-edge measurements have been performed on a number of mixed-valent Ce-based systems, along with their La- and Pr-based isomorphs. Contrary to several conjectures, the results imply that the ratio of the integrated intensities of the two edges observed in Ce-based systems is not altered appreciably by final-state effects and hence is a reflection of the 4f ground state. (18 refs.)

68362 Polarization-dependent phase and amplitude interference effects in the $L_{2,3}$ surface extended X-ray absorption fine structure. J.Stohr, R.Jaeger (Corporate Res. Sci. Labs., Exxon Res. & Engng. Co., Linden, NJ, USA).
Phys. Rev. B (USA), vol.27, no.8, p.5146-9 (15 April 1983).
The phase and amplitude of the surface extended X-ray absorption fine structure above L_2 and L_3 edges is shown to be significantly affected by an interference term. This term exhibits a different phase and a different polarization dependence of the amplitude than the leading term (pure $l=2$ final state). Neglect of this term in the data analysis can lead to erroneous determinations of chemisorption sites and distances. (8 refs.)

68363 *L*-edge X-ray absorption resonances in palladium silicides and palladium metal. G.Rossi (Stanford Electronics Labs., Stanford Univ., Stanford, CA, USA), R.Jaeger, J.Stohr, T.Kendelewicz, I.Lindau.
Phys. Rev. B (USA), vol.27, no.8, p.5154-7 (15 April 1983).
The Pd $L_{2,3}$ white line absorption has been measured for Pd metal, Pd_2Si, and PdSi to probe the variations in occupation of the Pd 4d states due to the rehybridization of the d band in the silicides. A reduction of the density of occupied states of d character in Pd_2Si and PdSi with respect to Pd metal is found, in agreement with partial-density-of-states calculations for the hybrid-bonded silicides. (25 refs.)

68364 EXAFS study of $FeCl_3$-doped polyacetylene. H.Kuroda, I.Ikemoto, K.Asakura, H.Ishii (Dept. of Chem., Univ. of Tokyo, Tokyo, Japan), H.Shirakawa, T.Kobayashi, H.Oyanagi, T.Matsushita.
Solid State Commun. (USA), vol.46, no.3, p.235-8 (April 1983).
Fe K absorption spectra of $FeCl_3$-doped polyacetylene $[CH(FeCl_3)_y]_x$ having y values of 0.024, 0.087 and 0.13, were measured by use of synchrotron radiation. The analyses of observed EXAFS data showed that Fe atom is surrounded by about four Cl atoms with Fe-Cl distance of 2.18-2.20 Å. It is concluded that the dopant exists mainly in the form of $FeCl_4^-$, and the following reaction takes place in the $FeCl_3$ doping process: $2FeCl_3+e^- \rightarrow FeCl_4^- + FeCl_2$. (18 refs.)

68365 Role of multielectron excitations in the L_3 XANES of Pd. M.Benfatto, A.Bianconi (Istituto di Fisica, Univ. di Roma, Roma, Italy), I.Davoli, L.Incoccia, S.Mobilio, S.Stizza.
Solid State Commun. (USA), vol.46, no.5, p.367-70 (May 1983).
High resolution L_3 and L_2 XANES (X-ray absorption near edge structure) spectra of Pd metal have been measured at the Frascati synchrotron radiation facility. The L_3 XANES shows an intense 2p→4d 'white line' while at the L_2 a weaker structure appears. A good agreement between L_3 XANES and the one-electron theory of Muller et al. (1982) has been found. All the possible final state effects due to the relaxation of the many body system are discussed. No many body effects have been seen on the 'white line' at threshold. The intensity ratio between L_3 and L_2 absorption is 2.1 in the high energy range of XANES and it is 2.7 at the white line maximum. A weak broad band extending up to 13 eV and centered at ~6 eV above the Fermi level, appearing in the L_3-L_2 difference spectrum, could be tentatively assigned either to the only possible very weak multielectron excitation present in XANES of Pd i.e. the 'two hole-two electron' excited state or to the prevalence of the j=5/2 total angular momentum for electrons in the 5 sp band, hybridized with the 4d band, up to 13 eV above the Fermi level. (26 refs.)

Determination of the local structure of metallic glasses by EXAFS ...... See Entry 66859

Local structures about some transition elements in oxide glasses using X-ray absorption spectroscopy ...... See Entry 66860

Characterization and structure of intergranular vitreous phases in ceramics ...... See Entry 66872

SEXAFS studies of adsorbate structure on Si and Ge surfaces ...... See Entry 67349

Short range antiferromagnetic ordering in fluoride glasses '$PbMnFeF_7$' and 'Pb_2MnFeF_9' ...... See Entry 67897

Spectroscopic properties of transition elements in glasses of geological interest ...... See Entry 68274

Energy factors of build-up of X-irradiation ...... See Entry 68711

78.70E X-ray emission threshold and fluorescence

68366 X-ray luminescence spectra of A_2B_6 ceramics. A.I.Proskura, V.Ya.Degoda.
J. Appl. Spectrosc. (USA), vol.37, no.1, p.787-9 (July 1982). Translation of: *Zh. Prikl. Spektrosk. (USSR)*, vol.37, no.1, p.71-4 (July 1982). [received: March 1983]
Ceramic materials were prepared by the hot pressing method. Specimens were cut in the form of cylindrical disks with a diameter of 14 and thickness of 2 mm. They were placed onto a copper refrigeration line in an evacuated cryostat with beryllium input and quartz output windows. The X-ray luminescence was excited by X-rays from a URS-50 IM apparatus with a chromium anticathode, and the energy of the characteristic X-ray radiation quanta from CR constituted 5.4 keV. The luminescence of the irradiated surface of the specimen was separated by a UM-2 monochrometer with 0.15 mm slits and was detected by FEU-79 and FEU-62 photomultipliers. (4 refs.)

Chemical shifts of SiKα and AlKα in oxide glasses ....See Entry 66861

Short range structure and some physical properties of the glasses in the system Na_2O-Ga_2O_3-SiO_2 ....See Entry 66871

X-ray spectral study of iron phosphides ....See Entry 67440

78.70G Microwave and radiofrequency interactions
(exc. resonances)

Microwave, infrared and Raman spectra and structure of 2-nitropropane ....See Entry 65966

Microwave, infrared and Raman spectra, conformation, and vibrational assignement of isopropylisocyanate ....See Entry 65967

Oscillation of the transparency of metals in a weak magnetic field ....See Entry 67671

Measurement of the indices of refraction and the absorption coefficients of dielectric materials in the millimeter wave region ....See Entry 68151

79.00 ELECTRON AND ION EMISSION BY LIQUIDS AND SOLIDS; IMPACT PHENOMENA

79.20 IMPACT PHENOMENA
(inc. electron spectra and sputtering)

79.20D Laser-light impact phenomena

68367 Resonance interaction between high-power ultrashort pulses of light with semiconductors. V.S.Dneprovskii (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Izv. Akad. Nauk SSSR Ser. Fiz., vol.46, no.3, p.586-92 (1982). English translation in: *Bull. Acad. Sci. USSR, Phys. Ser. (USA)*, vol.46, no.3, p.155-61 (1982). (Proceedings of the All-Union Seminar on the Optical Detection of Magnetic Resonances in Solids, Leningrad, USSR, 6-8 April 1981).
Reports an analysis of experimental data obtained in a study of the resonance interaction between powerful ultrashort pulses of light with A_2B_6 semiconductors in the case of one- and two-photon interband transitions and one-photon excitation of excitons. The author investigated the propagation of powerful ultrashort pulses of the first and second ($h\nu$=2.34 eV) harmonics of a neodymium laser (pulse length variable in the range 5×10^{-12}-10^{-9}) during one-photon excitation of excitons and one- and two-photon interband transitions in semiconductors of the form $CdS_{0.75}Se_{0.25}$. He also investigated the propagation of ultrashort pulses from a tunable rhodamine 6G dye laser (passive mode locking, pumped by a lamp) during the excitation of excitons in $CdS_{0.4}Se_{0.6}$ crystals. (25 refs.)

Infrared-laser-induced desorption by resonant multiphoton excitation of adsorbate vibration in CH_3F-NaCl at different coverages ....See Entry 67368

Thermodynamics of ion formation by fast dissipation of energy at solid surfaces ....See Entry 68396

79.20F Electron impact: Auger emission

68368 Auger electron spectroscopy of TiO_2:inter- and intra-atomic transitions connected with the valence band. S.Nishigaki (Dept. of Electric & Electronic Engng., Toyohashi Univ. of Technol., Toyohashi, Japan).
Surf. Sci. (Netherlands), vol.125, no.3, p.762-70 (March 1983).
Auger electron spectroscopy was employed as a probe of the valence band density-of-states. Cleaved TiO_2(110) surfaces were annealed, bombarded with Ar ions, and exposed to oxygen. The Ti-LMV Auger spectral shape was changed with various surface treatments. The annealed surface was nearly stoichiometric and exhibited the inter-atomic Auger transition, connected with the valence band originating from the oxygen 2p level, i.e. L(Ti)M(Ti)V(O). The ion bombarded surface, however, showed both inter- and intra-atomic Auger processes, the latter of which, L(Ti)M(Ti)V(Ti), occurred with the titanium 3d level occupied with electrons by oxygen defect formation. (20 refs.)

68369 Auger lineshape analysis. H.H.Madden (Sandia Nat. Labs., Albuquerque, NM, USA).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.80-100 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Auger transitions occurring at solid surfaces give spectra containing information on the energy distribution of valence electrons involved in the transition. Thus Auger electron spectroscopy (AES) can be used as a valence band (VB) spectroscopy that is surface sensitive. Analyses of a number of core-valence-valence (CVV) Auger spectra are reviewed to illustrate the VB information contained in their lineshapes and to indicate current understanding of the physics of the Auger process as it applies to solids. The KVV spectrum from elemental beryllium is an example of a CVV line that can be analyzed simply in terms of the sum of convolution products of independent-particle VB density-of-states (DOS) components. Other elemental solids for which such simple arguments suffice include Al, Si, Li, Ti, Co, and B. The CVV spectra from copper are discussed as examples of CVV lineshapes that are distorted from those expected from simple VB DOS arguments because localization in the two-hole Auger final state for Cu makes hole-hole interactions important in determining the Auger lineshapes. Initial state screening is shown to influence the CVV lineshapes from Be as well as Cu. CVV spectra from the compound surfaces BeO and SiO_2 are analyzed using concepts of interatomic transitions as well as independent-particle VB arguments. These spectra show that AES is a probe of the local DOS about the core-hole site. This ability of AES to give local bonding information is illustrated by analyses of CVV spectra from multi-component surfaces which may be made in terms of the simple superposition of local-bonding signals. Thus the Si-L_{23}VV signal from silicon oxynitride is shown to be the superposition of signals representing elemental Si, Si-H, Si-N and Si-O bonding. (72 refs.)

68370 An investigation of Auger electron signal as a function of sample and detector angles. R.L.Gerlach, R.C.Cargill (Phys. Electronics Div., Perkin-Elmer, Eden Prairie, MN, USA).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.565-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The effects of the sample to incident electron beam angle and of the detector angle on the Auger electron signal are important for quantitative Auger analysis, particularly for Auger mapping and line scans. A mean free path model is employed to simulate the Auger signal resulting from a range of sample and detector angles. The model approximates multiple scattering by a normal distribution of ionizing flux angles about the incident beam direction. Experimental observations compare favorably with predictions of the model for Ti and O Auger signals when the model is adjusted to include surface roughness. (6 refs.)

Segregation of As on GaAs(110) surfaces observed immediately after cleavage ....See Entry 67323

SIMS-AES investigations on water vapour adsorption on nickel (100) at room temperature ....See Entry 67340

Adsorption of N_2 and NH_3 on Mo(111) ....See Entry 67360

The adsorption study of tellurium on iron (001) surface by means of LEED, AES and $\Delta\phi$ ....See Entry 67361

Intensity anomalies of Auger electron signals observed by incident beam rocking method for Si(111)7$\times$7 and Si(111)$\sqrt{3}\times\sqrt{3}$Ag surfaces .. See Entry 67724

Nickel and copper on cleaved indium phosphide: structure, metallurgy and electronic properties ....See Entry 67778

UPS, XPS and Auger spectroscopies of tetrathiotetracene (TTT) and bis (tetrathiotetracene)-triiodide (TTT_2I_3) organic semiconductor surfaces ....See Entry 68402

AES study of the low-pressure oxidation of Si(100): electron beam effects ....See Entry 68678

79.20H Electron impact: secondary emission

68371 Polarized secondary electron spectroscopy, a new tool in solid state sciences. M.Erbudak, G.Ravano (Lab. fur Festkorperphys., ETH, Zurich, Switzerland).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.120-5 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Angle, energy, and spin resolved measurements of secondary electrons (SE) emitted from a gold target are used to gain information on the SE emission phenomenon. The results show that, above the plasma energy, the main SE excitation mechanism is electron-electron scattering. The spin exhange between the primary and secondary electron is determined for such a process. The results also given information on the angular distribution of SE in the solid as a function of their energy. In the transport/escape process, the SE can acquire a spin polarization via spin-orbit coupling in scattering at gold atoms. Such experiments can be used to learn more about the effective scattering potentials and to determine the elastic and inelastic mean free paths of electrons in the solid. (12 refs.)

68372 The effect of surface condition on the structure of the secondary emission spectrum of W(110). O.M.Artamonov, O.M.Smirnov, A.N.Terekhov (A.A. Zhdanov State Univ., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1612-13 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2844-6 (Sept. 1982). [received: April 1983]
The authors have studied the change in the shape of the secondary emission spectrum of a W(110) single crystal surface that occurs during the process of cleaning the surface and as a result of ion bombardment and annealing. The measurements were carried out in a low-energy electron spectrometer. The condition of the surface was checked by parallel measurements of the work function, the characteristics of the Auger spectra, and the energy dependence of the peak of elastically reflected electrons (diffraction effects). (7 refs.)

Surface magnetic properties of amorphous ferromagnets studied using electron spin polarization ....See Entry 67990

Potential emission from tungsten due to impact of slow metastable ions ....See Entry 68394

79.20K Other electron impact phenomena

68373 Large-angle electron-energy-loss spectroscopy with the inclusion of a surface image potential. B.M.Hall, S.Y.Tong (Dept. of Phys., Univ. of Wisconsin-Milwaukee, Milwaukee, WI, USA), D.L.Mills.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1277-80 (25 April 1983).
A full multiple-scattering calculation is reported for large-angle electron-energy-loss spectroscopy of H/W(001) with the inclusion of a surface image potential. The form of the image potential was determined by comparison with experimental data of elastic fine structures on W(001) and confirmed on W(110). With the inclusion of the image potential, good agreement is obtained with experimental data for the polar dependence of the electron-energy-loss cross section. Also, a breakdown of a pseudoselection rule for large-angle electron-energy-loss spectroscopy is illustrated. (9 refs.)

68374 Electron-energy-loss spectroscopy of polydiacetylenes. J.J.Ritsko (Inst. fur Festkorperforschung, KFA, Julich, Julich, Germany), G.Crecelius, J.Fink.
Phys. Rev. B (USA), vol.27, no.8, p.4902-8 (15 April 1983).
Electron-energy-loss spectra in the range 0.2-300 eV were measured for two types of polydiacetylene thin films were different sidegroups: polymers of 2,4-hexadiyn-1-ol and Langmuir-Blodgett films of the pentacosa-10,12-diinoic acid-Cd salt. The valence excitations are dominated by a π-electron plasmon above the 2-eV fundamental absorption edge. The plasmon dispersion is linear with a slope identical to similar plasma excitations in polyacetylene $[(CH)_x]$.

This implies that the π-electron bandwidth and interband exctation spectra are similar in these materials as suggested by recent theoretical band-structure calculations. Absorption begins at 2.0 eV for all momenta even at low temperature, consistent with the dominance of localized excitations at the fundamental edge, thus confirming the interpretation of earlier experimental work. (26 refs.)

68375 A novel technique for the identification of the surface plasmon in EELS. A.A.Ozkok, P.R.Webber, P.J.Dobson (Dept. of Phys., Imperial Coll., London, England).
Solid State Commun. (USA), vol.46, no.2, p.109-11 (April 1983).
In this work the authors report on angle-resolved Electron Energy Loss Spectroscopy (EELS) with grazing-emergent electrons, which has been used to enhance considerably the surface sensitivity of EELS and thus distinguish between surface and bulk-related loss features. Surface plasmon losses for Ni(001) are clearly identified at 7 eV and 14 eV. Also, a new interpretation is suggested for a loss peak observed at 10 eV. (11 refs.)

68376 EELS identification of the adsorbed species from acetone adsorption on Pt(111). N.R.Avery (Div. of Materials Sci., Univ. of Melbourne, Parkville, Victoria, Australia).
Surf. Sci. (Netherlands), vol.125, no.3, p.771-86 (March 1983).
Adsorption of acetone on a clean Pt(111) surface at 120K has been studied by high-resolution EELS and TDS. Two forms of associatively adsorbed acetone have been characterized and their structures determined. The more weakly bound, majority form, desorbs reversibly at 185K ($\Delta H_a \sim 11.6$ kcal mole^{-1}). The EELS spectrum of this species showed a carbonyl stretching band (A_1 symmetry) red shifted by 80 cm^{-1} together with the two B_1 skeletal modes, viz. ν_{as}(CC) and δ(CO), indicating bonding in an end on, through the oxygen, η^1(O) configuration, with the Pt—O—C bent most probably in the molecular plane. This form of adsorbed acetone is the analog of the labile inorganic acetone complexes which are widely exploited in synthesis reactions. The second more strongly bound, minority form of acetone, at 210-230K, partly desorbed molecularly while the remainder decomposed to CO_a, H_a and an adsorbed hydrocarbon residue with the stoichiometry C_2H_x. This form of adsorbed acetone showed no EELS bands due to skeletal modes but instead only bands due to methyl stretching, deformation and rocking modes, indicating side-on bonding in a configuration designated η^2(O,C). Its surface concentration was variable, depending on the region of the crystal surface probed by the EELS beam and consequently is associated with accidental, low-coordination, step sites. By inference, the η^1(O) form is associated with the well defined close packed regions of the ideal Pt(111) surface. (25 refs.)

68377 Low energy electronic and vibronic excitations of semiconductor surfaces. H.Luth (Phys. Inst., Rheinisch-Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.126-46 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The application of high resolution electron energy loss spectroscopy (HRELS) to the study of low energy excitations on semiconductor surfaces is discussed. Besides a short introduction into the scattering mechanism, examples are presented for the excitation of surface phonons and plasmons, intra- and interband scattering as well as for adsorbate vibrations. (42 refs.)

68378 Adsorption site of oxygen chemisorption on Ni(110) at room temperature; an EELS study. A.M.Baro, L.Olle (Dept. de Fisica Fundamental, Univ. Autonoma de Madrid, Madrid, Spain).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.170-6 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The authors use electron energy loss spectroscopy (EELS) to obtain the adsorption sites occupied during the chemisorption of oxygen on Ni(110) at room temperature. Three distinct spectra are observed. For low exposures (≤ 0.1 L) the vibrational spectrum shows two bands at 530 and 800 cm^{-1} which they interpret as due to oxygen adsorbed on a modified long bridge site. Increasing the exposure results in the observation of another band at 700 cm^{-1} which they interpret as due to the occupation of short bridge sites connected with the displacement of nickel atoms to reconstructed positions. Finally, at ~1 L the (2×1) structure is characterized by a vibrational mode at 420 cm^{-1}. These results are interpreted in terms of the missing row reconstruction model, the oxygen atoms populating the long bridge sites of the [001] reconstructed rows. (14 refs.)

68379 Low energy electron inelastic scattering at surfaces: application to Mg(0001) and $(1\bar{1}00)$. I. The clean metal surfaces. J.Ghijsen, P.A.Thiry, J.J.Pireaux, R.Caudano (Lab. de Spectroscopie Electronique, IRIS, FNDP, Namur, Belgium).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.177-82 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Clean (0001) and $(1\bar{1}00)$ faces of magnesium were investigated by Electron Energy Loss spectrometry, in order to study the surface and bulk plasmon intensities as a function of the primary beam energy and the outgoing beam orientation. Strong dependences are observed and tentatively interpreted by use of electron mean free path variation, channeling, and inelastic electron diffraction. (17 refs.)

68380 The electron energy loss spectra of some alkaline earth oxides. A.R.Protheroe, A.Steinbrunn, T.E.Gallon (Dept. of Phys., Univ. of York, Heslington, York, England).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.534-42 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The electron energy loss spectra of CaO, SrO and BaO have been measured in the range 0-50 eV for primary energies between 100-1300 eV. For CaO, comparison with $-\mathrm{Im}(1/\epsilon)$ calculated from optical data shows good agreement except in the region 11-15 eV. The electron energy loss spectra of SrO and BaO show great similarity to the spectrum of CaO. Two surface loss peaks are present in the bulk band gap of CaO and SrO, with a third present at the band edge having a surface contribution. The lowest energy loss peak has been shown to be induced by the electron beam. Barium oxide under electron bombardment differs in the respect that an additional loss peak is produced above the band gap possibly due to the liberation of free barium metal. (12 refs.)

68381 Total current spectra in transmitted and reflected electrons. S.A.Komolov, E.K.Alidzhanov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.93-6 (Feb. 1983). In Russian.
The results of comparative investigation of total current spectrum formation in reflected and transmitted electrons are discussed. It is shown that the fine structure of the spectrum is determined by elastically reflected electrons. Combined measurements of the total current spectrum and Auger spectrum made it possible to control the investigated surfaces. (8 refs.)

68382 Secondary electron spectroscopy study of valence and empty state density in CdS. S.A.Komolov, A.F.Pigulevskii, A.N.Terekhov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.96-9 (Feb. 1983). In Russian.
Two secondary electron emission methods—energy electron loss spectroscopy (EELS) and total current spectroscopy (TCS) are used to study a CdS single crystal. It is shown that the combined application of these methods makes it possible to investigate the characteristic features of the electronic structure of valence and empty state density near the Fermi level. Simultaneous analysis of CdS EELS and TCS spectra shows two maxima of the density energy function present in the empty state at 4.0 and 6.3±0.3 eV above the valence band edge. (6 refs.)

Spektroskopische Untersuching des Zustandes von Helium in Blasen in Aluminium und Nickel (Spectroscopic investigation of the state of helium in bubbles in aluminium and nickel) .... See Entry 66981

Segregation of As on GaAs(110) surfaces observed immediately after cleavage . ... See Entry 67323

Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). II. ELS and XPS studies .... See Entry 67364

Chemisorptive properties of Pt-Ni(111) single crystal alloys with high platinum content: C_2H_4 and C_6H_6 adsorption .... See Entry 67366

Vibrational excitations of hydrogen and oxygen on Pd(100) .... See Entry 67367

The two state nature of H-induced W(100) reconstruction .... See Entry 67370

The diamond (111) surface: a dilemma resolved .... See Entry 67723

Electronic and vibronic excitations of semiconductor surfaces studied by electron energy loss spectroscopy .... See Entry 67726

Auger recombination and non-linear refraction in cadmium-mercury telluride at 10.6 μm .... See Entry 68157

Vacuum ultraviolet spectroscopy of high-pressure helium microbubbles in metals .... See Entry 68285

Some properties of reactively sputtered tin lead oxide films .... See Entry 68351

79.20N Atom, molecule, and ion impact

68383 Trapping and reflection coefficients for ^{3}He in Ni at oblique incidence. C.K.Chen, W.Eckstein, B.M.U.Scherzer (Max-Planck-Inst. fur Plasmaphys., EURATOM-Assoc., Garching bei Munchen, Germany).
Appl. Phys. A (Germany), vol.A31, no.1, p.37-44 (May 1983).
The areal density and the depth distribution of ^{3}He trapped in Ni as a function of the bombarding fluence was measured in the energy range of 1-25 keV and at angles of incidence between 0 and 85° using nuclear reaction analysis. At fluences below saturation a linear relation is found between the areal density and the fluence. From its slope the trapping and reflection coefficients can be determined. The experimental data for trapping and reflection coefficients and for the depth profiles were compared with computer simulation results from the TRIM program. To reduce uncertainties in the absolute values of the experimental trapping coefficients, they were normalized to the TRIM values at normal incidence. The dependence of the measured reflection coefficient on the angle of incidence between 0 and 80° shows good agreement with the calculated data for incident energies from 3 to 25 keV, but for 1 keV the measured reflection coefficients are higher than the calculated ones. (21 refs.)

68384 Studies of surfaces of materials using low energy ion beams. I.S.T.Tsong (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1266-70 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Characterization of solid surfaces using low energy, i.e. ≤10 keV, ion beams has gained increasing popularity during the past decade. The three most commonly used low energy ion beam techniques are: secondary ion mass spectrometry (SIMS), sputter-induced photon spectrometry (SIPS) and ion scattering spectrometry (ISS). As far as detection sensitivity is concerned, SIMS is probably superior to almost all surface analytical techniques. Impurity levels in the parts per million range can be easily determined. SIMS is widely applied to semiconductor problems in which concentration-versus-depth information is usually sought. SIPS is especially suited to compositional analysis of non-conducting materials since, unlike techniques based on detection of charged particles, charging of the sample surface by the primary beam does not affect the collection of optical radiation from sputtered excited atoms. ISS is probably the best available technique for studying the composition of the topmost surface layer of any material. Its monolayer sensitivity due to the properties of low energy scattering is unique among surface analytical techniques. This paper discussed the use of each of these three techniques to solve problems in materials science. (16 refs.)

68385 RBS microscopic 'tomography'. R.D.Edge (Phys. Dept., Univ. of South Carolina, Columbia, SC, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1685-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The resolving power of optical and electron microscopes is limited by diffraction, scattering being also a problem with electron microscopes, and ion source properties in the case of ion microprobes. Essentially, the resolution is determined by the hardware. The author has developed a technique involving simple equipment but extensive computer analysis following the taking of data. The profile and internal constitution of periodic surfaces and micro sizes objects is measured by irradiating them uniformly with a parallel beam of ions. The Rutherford backscattered spectra, observed at different angles using solid state detectors, are analyzed in a manner similar to that employed in tomography to yield the structure of the object irradiated. The ultimate resolution is determined by ion straggling, rather than diffraction. (11 refs.)

68386 Sputtering from binary alloys—a technique for evaluating change in surface binding energy. G.W.Reynolds (State Univ. of New York, Albany, NY, USA), T.G.Allas, J.M.Lambert, P.A.Treado.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1749-51 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The authors evaluate the sputtering process from the onset of ion bombardment through the steady state condition. From these experiments models have been proposed for the behavior of the surface composition and the sputtering yields. Techniques developed for monitoring of the surface have provided data supporting the concept that the average surface binding energy of the bombarded target material is sensitive to the sputtering process. Calculating the manner in which the surface binding energy will change with the developing atomic surface fraction can qualitatively lead to more precise prediction of implantation requirements. (14 refs.)

68387 How well does ^{4}He backscattering from low-Z nuclei obey the Rutherford formula?. J.R.MacDonald, J.A.Davies, T.E.Jackman (Chalk River Nuclear Labs., AECL, Chalk River, Ontario, Canada), L.C.Feldman.
J. Appl. Phys. (USA), vol.54, no.4, p.1800-3 (April 1983).
A study of ^{4}He backscattering (150°) cross sections for O, Al, and Si atoms in the energy range 0.6-2.3 MeV has been completed. The authors conclude that the ^{4}He backscattering cross section for these elements follows the E^{-2} energy dependence of Rutherford backscattering to 1%-2% over this energy range. These results have significant implications for the use of ^{4}He backscattering as a materials analysis tool for low-Z elements. (9 refs.)

68388 Simultaneous TOF spectra of sputtered and scattered neutrals and ions from 3 keV Ne$^+$, Ar$^+$, and Ar^{2+} bombardment of CsBr. J.W.Rabalais, J.A.Schultz, R.Kumar, P.T.Murray (Dept. of Chem., Univ. of Houston, Houston, TX, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5250-9 (15 April 1983).
A spectrometer system for simultaneous mass and velocity analysis of scattered and sputtered ions and velocity analysis of fast neutrals ejected from a surface by bombardment with a pulsed ion beam is described. Combination secondary ion and scattered neutral plus ion TOF spectra and their corresponding energy spectra for 3 keV Ar$^+$ and Ar^{2+} bombardment of CsBr are presented. Selective sputtering of Brdown to a steady state level is observed with Ne$^+$ bombardment with an estimated depletion cross section of 10 Å ^{2}. Scattering spectra of neutrals plus ions and neutrals alone allow determination of scattered Ar$^+$ ions survival fractions of 0.22 and 0.13 from 3 keV Ar$^+$ collisions with Cs Br, respectively. This indicates preferential neutralization during scattering from Br. Ion fractions for Ar^{2+} and Ar$^+$ are determined for Ar^{2+} scattering, illustrating the stepwise neutralization process for multiply charged ions. With 3 keV Ar^{2+} bombardment the fractions surviving as Ar$^+$ for Cs and Br collisions are 0.18 and 0.08, respectively, while the fraction surviving as Ar^{2+} is $\sim$0.10 for both atomic collisions. The ion fraction data are interpreted in terms of Auger and resonant neutralization transitions between the ion and specific surface atoms. (39 refs.)

68389 Control of silicon dioxide properties by RF sputtering. M.K.Lee, C.Y.Chang, J.S.Tzeng, Y.K.Su (Res. Inst. of Electronics & Electrical Engng., Nat. Cheng Kung Univ., Tainan, Taiwan).
J. Electrochem. Soc. (USA), vol.130, no.3, p.658-62 (March 1983).
Examines the effect of simultaneously sputtered Teflon on the properties of sputtered silicon dioxide films. C-V measurements show that positive ions in sputtered silicon dioxide can be compensated. They also show that the compensation effect can be controlled by the negative voltage of bias sputtering during deposition. (12 refs.)

68390 Comment on 'Molecule formation during sputtering by two-body associative ionization with diabatic curve crossing. C.M.Loxton, I.S.T.Tsong (Dept. of Phys., Arizona State Univ., Tempe, AZ, USA), S.H.Lin, K.Snowdon, W.Heiland.
Phys. Rev. Lett. (USA), vol.50, no.17, p.1331-2 (25 April 1983).
A model for the formation of excited molecular ions has recently been proposed by Snowdon, Heiland, and Taglauer (see ibid., vol.46, p.284, 1981). Experimental evidence for the model is presented with the identification of $N_2{}^+$ molecular emission in the wavelength range 400-430 nm, observed during the bombardment of Si by 0.5 to 6 keV $N_2{}^+$. The purpose of this comment is to demonstrate that these spectral features are those from the SiN $B^2\Sigma$-$X^2\Sigma$ system. (9 refs.)

68391 Diffraction of He atoms from a Xe overlayer adsorbed on graphite (0001). G.Bracco, P.Cantini, A.Glachant, R.Tatarek (Istituto di Sci. Fisiche, Univ. di Genova, Genova, Italy).
Surf. Sci. (Netherlands), vol.125, no.3, p.L81-6 (March 1983).
He beam scattering from a $(\sqrt{3}\times\sqrt{3})$R30° lattice of xenon adsorbed on the graphite (0001) surface is measured. The experimental data at normal incidence, fitted by the hard-wall model and the eikonal approximation, yield a peak-to-peak corrugation amplitude of 0.88 ± 0.02 Å. The agreement is only qualitative and points to the need for a more accurate analysis, with calculations suitable for large corrugation amplitudes. (14 refs.)

68392 Secondary ion yield variations due to cesium implantation in silicon. K.Wittmaack (Gesellschaft fur Strahlen- und Umweltforschung mbH, Phys.-Tech. Abteilung, Neuherberg, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.573-80 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The intensity variations of atomic and molecular secondary ions emitted from cesium-bombarded silicon have been investigated at impact energies between 2 and 12 keV. Accumulation of implanted cesium was found to enhance the Si$^-$ intensity by up to five orders of magnitude. Simultaneously, Cs$^+$ emission is suppressed by more than two orders of magnitude. During cesium implantation the energy distribution of Si$^-$ (Cs$^+$) shifts towards lower (higher) energies. The Si$^-$ (Cs$^+$) intensity increases (decreases) with decreasing impact energy. Measurements involving $Si_n{}^-$ cluster ions suggest that the stationary surface concentration of cesium increases with decreasing impact energy. The observed phenomena are apparently affected by even weak electric fields at the sample surface and by bombardment-induced diffusion. Nevertheless the work function appears to be the key parameter governing both negative and positive secondary ion yields. (22 refs.)

68393 Neutralization of keV ions scattered by Ag(110). A.G.J.de Wit, J.M.van Zoest, J.M.Fluit (Fysisch Lab., Rijksuniv. Utrecht, Utrecht, Netherlands).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.589-97 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The scattering of 1-6 keV He$^+$, Ne$^+$ and H$_2$O$^+$ ions by Ag(110) was studied. Intensity measurements of singly scattered ions for different azimuthal and polar angles of incidence were combined to photograms of the first surface layers showing their blocking and shadowing behaviour for the different directions. Positive ions show decreasing yields with depth, whereas negative ions show increasing yields with depth (for the first layers). Ratios of the yields for ion scattering by the first and by the second layer are determined for Ne$^+$ ions going along different trajectories between these two layers. The necessity of a locally variable neutralization probability to describe these results is shown. (12 refs.)

68394 Potential emission from tungsten due to impact of slow metastable ions. W.Hofer, W.Vanek, P.Varga, H.Winter (Inst. fur Allgemeine Phys., Tech. Univ. Wien, Vienna, Austria).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.605-9 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Presents energy distributions of secondary electrons emitted from polycrystalline clean and gas-covered tungsten due to impact of slow singly-charged metastable noble gas ions (10-100 eV). The ion deexcitation and neutralization processes are discussed by comparing the authors' experimental results with computed ejected-electron energy distributions using the semi-empirical theory of Hagstrum (1954). Since the potential energy of impinging ions strongly influences the electronic interactions, the ejected-electron energy distribution yields information on the respective initial ion states. This has also been applied for determination of metastable ion beam fractions for some standard ion sources. (6 refs.)

68395 A singularity in the interaction of high-energy singly-charged ions with a nonmetallic crystal surface. I.V.Vorob'eva, Ya.E.Geguzin, V.E.Monastyrenko (Gor'kii State Univ., Kharkov, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1626-7 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2866-7 (Sept. 1982). [received: April 1983]
In studying regularities in the interaction of singly-charged high-energy ions with crystals it is important to determine the nature and magnitude of the energy loss. The authors investigate this aspect of the problem, by irradiating gypsum single crystals ($CaSO_4.2H_2O$) with a $_{54}Xe^{132}$ ion beam. The structure of the irradiated surfaces were examined with an electron microscope using the angle-offset replica method. (3 refs.)

68396 Thermodynamics of ion formation by fast dissipation of energy at solid surfaces. F.R.Krueger (Max-Planck-Inst. fur Kernphys., Heidelberg, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.385-94 (April 1983).
A fast dissipation of a certain amount of energy at a solid surface, by any mechanism whatsoever, may cause a non-equilibrium phase transition of the surface material forming, nearly instantaneously, a relatively large amount of gaseous molecular and atomic ions. This is a phenomenon common to many techniques utilized to create ions especially from organic solids. The thermodynamics of these processes are deduced from first principles; physical properties (kinetic energy and angular distributions, excitation energy) and chemical properties (ion types, mass spectra and intensities) are derived. Like 'temperature' as an intensive quantity plays a major role in equilibrium thermodynamics, 'action' as an extensive quantity takes the counterpart in this very far-from-equilibrium behaviour. (33 refs.)

Utilization of charged particle backscattering to study the near surface region of glasses. Application to depth profiling of lanthanium, cerium, thorium and uranium induced by aqueous leaching .... See Entry 65461

Radiative electron capture (REC) as an indicator of the K-vacancy state of highly ionized projectiles in solids: application to stopping power .... See Entry 66105

A comparative study of the dopant profiles in diffused planar optical waveguides by SIMS and guided wave probe .... See Entry 66382

Recent work using the ANL HVEM-ion beam interface .... See Entry 67056

The analysis of Rutherford scattering-channelling measurements of disorder production and annealing in ion irradiated semiconductors .... See Entry 67061

Stoichiometry effects at NiMo surfaces under bombardment with Ar$^+$ ions from 40 to 2000 eV .... See Entry 67062

Sputtering of the surface of gold by fission fragments .... See Entry 67066

Potential information and stopping power from channeling in diamond .... See Entry 67070

Application of nuclear analysis methods to nondestructive measurements of concentration profiles of the surface region of glasses by aqueous leaching .... See Entry 67320

Direct analysis of the structure, concentration, and chemical activity of surface atomic vacancies by specialized low-energy ion-scattering spectroscopy: TiC(001) .... See Entry 67321

Vibrational properties of Au and Pt(110) surfaces deduced from Rutherford backscattering data .... See Entry 67338

SIMS-AES investigations on water vapour adsorption on nickel (100) at room temperature .... See Entry 67340

Auger electron spectroscopy of TiO$_2$:inter- and intra-atomic transitions connected with the valence band .... See Entry 68368

Initial stages of the oxidation of zirconium studied by X-ray photoelectron spectroscopy and secondary-ion mass spectroscopy .... See Entry 68697

A static SIMS rate measurement of the reaction $2H(a)+O(a)\rightarrow H_2O(a)$ on Pt(111) .... See Entry 68797

Sputtering analysis with PIXE .... See Entry 68821

79.20R Atomic and molecular beam interactions

Diffraction of He atoms from a Xe overlayer adsorbed on graphite (0001) .... See Entry 68391

79.40 THERMIONIC EMISSION

Electron-energy distribution in silicon under pulsed-laser excitation .... See Entry 68405

79.60 PHOTOEMISSION AND PHOTOELECTRON SPECTRA

68397 Two valence states in oxidized europium metal. J.Barth, F.Gerken, J.Schmidt-May (II. Inst. fur Experimentalphys., Univ. Hamburg, Hamburg, Germany), A.Flodstrom, L.I.Johansson.
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.532-6 (22 April 1983).
Evaporated Eu films were exposed to oxygen up to 100 L. Using novel techniques of photoelectron spectroscopy in connection with synchrotron radiation as a tunable light source the authors detect the presence of both Eu^{2+} and Eu^{3+} ions in the sample with a close correspondence to mixed-valence Eu$_3$O$_4$. At elevated temperature (400°C) only Eu^{2+} is found. (20 refs.)

68398 Comment on 'X-ray photoelectron spectroscopic studies of oxygen chemisorption on thick films of photoconducting cadmium sulfide'. M.Lichtensteiger, C.Webb (Coulter Systems Corp., Bedford, MA, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.2127 (April 1983).
For original paper see D.P. Amalnerkar et al., Appl. Phys. Lett., vol.41, p.270 (1982). A recent paper by Amalnerkar, et al. on X-ray photoelectron spectroscopic studies of oxygen chemisorption on thick films of photoconducting cadmium sulfide, is compared and contrasted with literature data and earlier studies by the authors. They find that the interpretation of the XPS($2p$) features by Amalnerkar et al. cannot be correct. The source of confusion is identified as originating from indeterminate stray AlK$_\alpha$ radiation. (7 refs.)

68399 The electronic structure of polyphenyls and poly(p-phenylene). W.K.Ford, C.B.Duke, A.Paton (Xerox Webster Res. Center, Rochester, NY, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4734-42 (1 April 1983).
The ultraviolet photoemission, optical absorption, and core-level shakeup spectra of *p*-phenylene oligomers and poly(*p*-phenylene) are analyzed using the spectroscopically parametrized CNDO/S3 model. The densities of valence states are calculated for these molecules and shown to provide a good description of available photoemission spectra. Photogenerated radical cation states can be delocalized over four or more phenyl moieties in the solid-state oligomers. The relationship between the density of valence states and the energy band structure of macromolecules of poly(*p*-phenylene) is established. The energies of the lowest energy electronic excitations of *p*-phenylene oligomers are evaluated and shown to describe well the available UV absorption and XPS shakeup measurements. The influence of disorder in the solid state is assessed by analysis of the influence of macromolecular conformation on the electronic structure. (44 refs.)

68400 Ionic salt limit in graphite-fluoroarsenate intercalation compounds. J.W.Milliken (Moore School of Electrical Engng., Univ. of Pennsylvania, Philadelphia, PA, USA), J.E.Fischer.
J. Chem. Phys. (USA), vol.78, no.9, p.5800-8 (1 May 1983).
Starting with $C_{8n}AsF_5$ intercalation compounds of stage $n=1$ and 2, the authors have recorded changes with fluorine uptake in basal plane conductivity and its temperature variation, reflectivity and C(1*s*) core level X-ray photoemission spectra. The data are all consistent with an ionic salt limit C_{20}^+ (0.05 electrons per C atom extracted by oxidation) beyond which direct fluorination takes place. Defect scattering from the resulting C-F bond sites is shown to be the conductivity-limiting factor, rather than π charge localization around AsF_6^- sites. The present results also support the authors' previous conclusions that the oxidation of the initial compounds by AsF_5 goes only 40% and 52% to completion for stages 1 and 2, respectively. (40 refs.)

68401 Non linear photoemission from silicon. M.Bensoussan, J.M.Moison (CNET, Bagneux, France).
Physica B & C (Netherlands), vol.117-118 B+C, pt.1, p.404-9 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Two well-defined photoemission regimes are observed from clean (111) Si surfaces under various laser irradiation conditions and photon energies. At low fluences and at photon energies above half the work function two and three quantum process are the outstanding emission mechanisms. Density of state effects of initial and intermediate states appear as the dominant spectral features. At higher fluences or at low photon energies the prevailing emission is thermoemission characterized by a Maxwellian distribution revealing a temperature quite different from the lattice one during the excitation pulse. (21 refs.)

68402 UPS, XPS and Auger spectroscopies of tetrathiotetracene (TTT) and bis (tetrathiotetracene)-triiodide (TTT_2I_3) organic semiconductor surfaces. J.P.Delrue, J.P.Boutique, J.Riga, J.J.Verbist (Lab. de Spectroscopie Electronique, Facultes Univ. Notre-Dame de la Paix, Namur, Belgium), Y.Canivez, L.D.Laude.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.623-5 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Low energy angle integrated photoemission spectra of tetrathiotetracene (TTT) and of the organic molecular complex bis (tetrathiotetracene)-triiodide (TTT_2I_3) are compared to those obtained by X-ray photoelectron spectroscopy. Auger spectroscopy has also been tentatively used to characterize the surfaces of these two samples. (10 refs.)

68403 Exploiting photon energy dependence in photoemission from Si(111)-Mo interface. G.Rossi, I.Abbati, L.Braicovich, I.Lindau, W.E.Spicer, U.del Pennino, S.Nannarone (Stanford Electronics Labs., Stanford, CA, USA).
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.795-7 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
The authors present synchrotron radiation photoemission data from Si(111)-Mo in the coverage range 0.5-20.5 monolayers. Intermixing takes place at room temperature. The energy dependence of 4d photoemission cross section is used to discuss the nature of the chemical bond in the reacted region. (6 refs.)

68404 Photoemission studies of reactive diffusion and localized doping at II-VI compound semiconductor-metal interfaces. L.J.Brillson, C.F.Brucker (Xerox Webster Res. Center, Rochester, NY, USA), N.G.Stoffel, A.Katnani, R.Daniels, G.Margaritondo.
Physica B & C (Netherlands), vol.117-118 B+C, pt.2, p.848-50 (March 1983). (Proceedings of the 16th International Conference on the Physics of Semiconductors, Montpellier, France, 6-10 Sept. 1982).
Soft X-ray photoemission spectroscopy measurements reveal strong differences in chemical bonding and diffusion between II-VI and III-V compound semiconductor-metal interfaces which provide a chemical basis for their systematic differences in Schottky barrier formation. (16 refs.)

68405 Electron-energy distribution in silicon under pulsed-laser excitation. M.Bensoussan, J.M.Moison (Dept. OMT/PMS, CNET, Bagneux, France).
Phys. Rev. B (USA), vol.27, no.8, p.5192-5 (15 April 1983).
By yield and energy-distribution measurements, the authors identify two photoemission regimes from silicon under nanosecond laser irradiation. At low fluence and high photon energy, two- and three-quantum processes are the main emission mechanisms; effects of initial and intermediate states are the dominant spectral features. At high fluence and low photon energy, thermoemission prevails and is characterized by a Maxwellian distribution with a temperature different from that of the lattice during the excitation pulse. (14 refs.)

68406 Photoemission from MBE grown III-V surfaces and interfaces. P.K.Larsen (Philips Res. Labs., Eindhoven, Netherlands), J.F.van der Veen.
Surf. Sci. (Netherlands), vol.126, no.1-3, p.1-19 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Recent theoretical and experimental studies of the electronic and geometrical properties of polar III-V surfaces and interfaces with Group IV elements are reported. Angle resolved photoemission studies using synchrotron radiation and surface sensitive core level photoemission of reconstructed GaAs(001) surfaces prepared by molecular beam epitaxy are treated in some detail and compared with theoretical surface band structure calculations. Interface and heterojunction properties of overlayers of Group IV elements (Pb, Sn and Ge) on the GaAs(001) surface are discussed. (62 refs.)

68407 Angular resolved photoemission of InSb(001) and heteroepitaxial films of α-Sn(001). H.Hochst, I.Hernandez-Calderon (Max-Planck-Inst. fur Festkorperforschung, Stuttgart, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.25-31 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Angular resolved ultraviolet photoemission spectra (ARUPS) of InSb(001) and of heteroepitaxial grown α-Sn(001) films are reported for the first time. Results from normal emission spectra are explained by direct transitions into a parabolic free-electron-like final states band. The experimentally obtained dispersion $E(k)$ along ΓX agrees well with the non-local pseudopotential band structure calculation by Chelikowsky and Cohen (1976). Other band structure calculations of α-Sn exhibiting smaller dispersion of the first valence band towards the X_5 point fail to explain the photoemission data. (17 refs.)

68408 Physisorption on a low work function metal: ARUPS from xenon on cesium. H.H.Rotermund, K.Jacobi (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.32-40 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Angle-rsolved UV photoelectron spectra of Xe physisorbed on Cs films were measured using HeI (21.2 eV) radiation. The Ni(110) cryosurface, onto which the Cs was evaporated, was cooled down to 20K prior to Xe admittance. Physisorbed on bulk Cs, Xe does not change the work function. The relaxation of the Xe 5p photoemission peaks does not differ between the first and second Xe layer. Both results together support strongly the authors' model for the level alignment of physisorbed species. First results of Xe interacting with surfaces covered by submonolayer amounts of Cs are presented. (15 refs.)

68409 XPS and UPS study of Pb monolayers on polycrystalline Pd. D.Chadwick, M.A.Karolewski (Dept. of Chem. Engng. & Chem. Technol., Imperial Coll., London, England).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.41-8 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The deposition of up to 10 monolayers of Pb on polycrystalline Pd has been studied by XPS and UPS. Core-level binding energy shifts with coverage are reported. It is found that Pb forms initially a two-dimensional layer, followed by surface alloying at coverages above one monolayer. (21 refs.)

68410 Valence level photoelectron spectroscopy of the oxygen and carbonate species on silver (110). K.C.Prince, A.M.Bradshaw (Fritz-Haber-Inst., Max-Planck-Gesellschaft, Berlin, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.49-57 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
Atomic oxygen, associatively adsorbed oxygen and the carbonate species on Ag(110) have been studied using valence level photoelectron spectroscopy. For the (3×1) atomic oxygen overlayer dispersion of an O-2p-induced feature above the Ag-d band is observed, indicative of adsorbate band formation. In the associatively adsorbed species it appears that the former $1\pi_g$ molecular orbital (a_2+b_1 in C_{2v}) is completely filled as a result of the interaction with the surface. Despite the very strong lowering of the O-O stretching frequency observed in EELS, the $3\sigma_u(a_1)$ orbital is apparently not occupied. The electronic structure of the surface carbonate is shown to be similar to that of a bulk carbonate, confirming the conclusions of Madix (1981). (19 refs.)

68411 Thermal effects in UV photoemission from Cu(110). H.Martensson, C.G.Larsson, P.-O.Nilsson (Dept. of Phys., Chalmers Univ. of Technol., Goteborg, Sweden).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.214-18 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The temperature dependence of UV photoemission intensities from Cu(110) was studied in both mirror planes. Strong variations in the temperature dependence was found as the emission angle was changed, in disagreement with simple kinematical theory. These variations are different for different mirror planes, but similar for different d-band peaks in the same mirror plane. These findings raise questions about the importance of the wave-vector in connection with thermal effects. The temperature sensitivity is expected to increase with increasing emission angle due to enhanced surface vibrations, but in the case of emission in the ΓLUX plane the increase was qualitatively reproduced by 'time-reversed LEED' calculations without accounting for enhanced vibrations. The measured thermal sensitivity was however considerably larger than the calculated. (9 refs.)

68412 C(1s) spectroscopy of hydrocarbons adsorbed on Pt(111). N.Freyer, G.Pirug, H.P.Bonzel (Inst. fur Grenzflachenforschung und Vakuumphys., KFA Julich, Julich, Germany).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.487-94 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The temperature dependence of the interaction of C_2H_2 and C_2H_4 with Pt(111) was followed by measurements of the C(1s) binding energy shift. Different surface species, such as previously identified by EELS, UPS and LEED, can be distinguished by their corresponding C(1s) binding energy. At 100K adsorption temperature C_2H_2 and C_2H_4 are characterized by C(1s) binding energies of 284.0 eV and 283.4 eV, respectively. A quantitative evaluation of the C(1s) peak areas yields saturation coverages of about 0.5 molecule per Pt atom for C_2H_2 and C_2H_4 at 100K. The same coverage was also determined for the conditions of the 2×2 LEED patterns. In addition the C(1s) peaks were measured for C_2H_5Cl and C_2H_3Cl on Pt(111) at 110 and 300K. These species adsorb predominantly in molecular form at 110K but are dissociated at 300K. (24 refs.)

68413 Dispersion relation E(k) for s and p bands of gold in the LQW direction. G.A.Katrich, L.S.Miroshnichenko (Inst. of Phys., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1650-2 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.2912-15 (Oct. 1982). [received: April 1983]
Photoelectron spectra were studied in gold with a work function decreased by the adsorption of barium monoxide, in the energy range $h\nu \leq 4.1$ eV. Photoelectron emission into the band 'forbidden' in the one-electron approximation was found. Relations $E(k)$ for the *s* and *p* bands, and features of these, were found which differ from the theoretical predictions. The need to take account of many-particle effects in the photoemission process was noted. (9 refs.)

Altered glasses: surface analysis study ....See Entry 67319
GaAs (001)-c(4×4): a chemisorbed structure ....See Entry 67353
Adsorption of N_2 and NH_3 on Mo(111) ....See Entry 67360

Low temperature coadsorption of hydrogen and carbon monoxide on Ni(100). I. TPD, $\Delta\phi$, and UPS studies .... See Entry 67363

Valence band structure of hydrogenated amorphous silicon-carbon alloys studied by photoelectron spectroscopy .... See Entry 67433

Dependence of a hydrogen-like impurity spectrum on the magnetic field orientation in the crystal .... See Entry 67537

The diamond (111) surface: a dilemma resolved .... See Entry 67723

Electron states at abrupt metal-GaAs(110) interfaces .... See Entry 67727

Core-level photoemission studies of MBE-grown semiconductor surfaces .... See Entry 67728

The interaction of hydrogen with surface states on GaAs(100) .... See Entry 67732

Observation of nonuniform energy band shifts for Ge on GaAs(100) .... See Entry 67733

Temperature dependence of surface electronic structure of Si(111) surface .... See Entry 67737

Electronic structure evolution of Pd overlayers on Cu .... See Entry 67738

Electronic structure of the HCP phase of silver-aluminum alloys .... See Entry 67739

Surface core-level shifts at the end and beginning of the transition metal series .... See Entry 67740

Core level shifts and valence change at the surface of intermetallic rare-earth systems .... See Entry 67741

Formation of the Schottky barrier at the Pd/Si interface .... See Entry 67749

Nickel and copper on cleaved indium phosphide: structure, metallurgy and electronic properties .... See Entry 67778

An XPS study of silicon/noble metal interfaces: bonding trends and correlations with the Schottky barrier heights .... See Entry 67779

Electronic properties of gold-silicon (111) 7×7 interfaces .... See Entry 67781

Systematic study of 3d transition metal-silicon interfaces by photoemission .... See Entry 67782

Si-metal interface reaction and bulk electronic structure of silicides .... See Entry 67783

X-ray photoelectron spectroscopy study of hydrogen plasma interactions with a tin oxide surface .... See Entry 68671

Initial stages of the oxidation of zirconium studied by X-ray photoelectron spectroscopy and secondary-ion mass spectroscopy .... See Entry 68697

80.00 CROSS-DISCIPLINARY PHYSICS AND RELATED AREAS OF SCIENCE AND TECHNOLOGY

Interdisciplinary approaches in physics—the concepts .... See Entry 64643

81.00 MATERIALS SCIENCE

Physics of Non Crystalline Solids. Proceedings of the 5th International Conference .... See Entry 64580

81.10 METHODS OF CRYSTAL GROWTH AND PURIFICATION

(for physics of crystal growth, see 61.50C; for epitaxial growth methods, see 81.15)

Low-cost solar array progress and plans .... See Entry 68880

81.10B Growth from vapour

68414 **Regulation of mass transfer in a zinc selenide-hydrogen-inert gas transport system.** L.M.Kulikov (Inst. of Problems in Materials Technol., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.753-6 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.899-903 (June 1982). [received: Feb. 1983]
The use of an inert gas in a mixture with a chemically active transporting carrier gas makes it possible to effectively regulate the rate of deposition of zinc selenide over a wide range; this is particularly valuable in the growth of doped layers or single crystals. In the examined variants of the application of a mixture of inert and chemically active carrier gases the rate of deposition is lower as compared with that for a system with the utilization of a chemically active gas. The chemically active and inert carrier gases may improve the distribution of the rate of growth along the deposition surface and thereby increase the quality of the resulting layers or single crystals of zinc selenide. (6 refs.)

68415 **Preparation and investigation of large single crystals of $Zn_xCd_{1-x}Se$ solid solutions.** L.D.Budennaya, A.I.Nizkova, G.S.Pekar', G.N.Polisskii (Inst. of Semiconductors, Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.760-4 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.908-12 (June 1982). [received: Feb. 1983]
It was shown that the method of 'free growth' from the gas phase makes it possible to obtain large homogeneous single crystals of solid solutions from the components, the pressures of the saturated vapors of which at the growth temperature differ substantially (by several tens of times) from one another. Single crystals of $Zn_xCd_{1-x}Se$ solid solutions ($1 \geq x \geq 0$) with weights up to 200 g, which have a high degree of homogeneity of their characteristics and structural perfection, were grown by this method. (12 refs.)

68416 **The role of the pretreatment of the source material in chemical transport processes; effect of oxygen on growth of ZnS.** W.Palosz (Inst. of Phys., Warsaw Tech. Univ., Warsaw, Poland).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.412-14 (March 1983).
The influence of annealing of the starting material on the mass transport rate in the ZnS:I system is presented. The role of oxygen ($ZnSO_4$) present in the source material in the mass transport rate is discussed. (4 refs.)

A combined vacuum interlock and preparation assembly for MBE and surface analysis .... See Entry 64914

Composition of the gas phase in the Cd-Te-N-H-I system .... See Entry 66663

Growth and morphology of single crystals of hexagonal molybdates(IV) $M_2Mo_3O_8$ (M=Mn, Fe, Co, Ni) .... See Entry 66911

81.10D Growth from solutions

68417 **Preparation of lead sulfobromide single crystals.** V.I.Popolitov, Yu.M.Mininzon, A.N.Lobachev (A.V. Shubnikov Inst. of Crystallography, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.7, p.955-8 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1130-5 (July 1982). [received: Feb. 1983]
A variety of lead hydrosulfite, hydrosulfide/halide, and halide complexes can be formed in the Pb-S-HBr-H_2O system. The concentration of lead, sulfur, and bromine in supersaturated solutions varied depending on the predominance of particular complex and thereby affected the separation sequence and yield of $Pb_7S_2Br_{10}$, $PbBr_2$ and PbS single crystals. The effect of charge composition on the yield and formation sequence of $Pb_7S_2Br_{10}$, $PbBr_2$ and PbS single-crystal phases was examined for the following systems: Pb-S-HBr-H_2O, Pb-S-BR-HBr-H_2O, PbS-Br-HBr-H_2O, PbS-Pb-Br-HBr-H_2O, PbS-Pb-Br-S-HBr-H_2O, $PbBr_2$-PbS-S-HBr-H_2O, and $PbBR_2$-S-HBr-H_2O. The $Pb_7S_2Br_{10}$ single crystals were prepared by separating the charge components in isolated solvents. (8 refs.)

68418 **Evaluation of the spin-up time during the accelerated crucible rotation technique.** A.Horowitz, M.Goldstein (Dept. of Chem., Nuclear Res. Center, Negev, Beersheva, Israel), Y.Horowitz.
J. Cryst. Growth (Netherlands), vol.61, no.2, p.317-22 (March 1983).
The transient flows occurring after a change in the angular velocity of a cylindrical container are described. The dependence of the transient (known as the spin-up or spin-down time) on experimental parameters such as kinematic viscosity, cylinder dimensions and the cylinder's initial and final angular velocities are elucidated by a review of the literature. It is emphasized that with large Rossby numbers the spin-up time is longer and the amount of fluid mixing is greater than with small and moderate Rossby numbers. It is also elucidated that most crystal growth crucibles cannot be considered as infinitely-long cylinders for the evaluation of the fluid dynamics. (16 refs.)

Influence of gravitation on the processes of heat and mass transfer in solution crystal growth by the travelling heater methods (THM). III .... See Entry 66903

Crystallization of potassium sulfate from pure aqueous solution and in presence of surfactants .... See Entry 66907

Growth morphology of polar crystals: a comparison between theory and experiment in sucrose .... See Entry 66912

Dislocation etching of tin iodide single crystals .... See Entry 66995

Iso-epitaxial growth of n-octacosane crystals .... See Entry 67382

81.10F Growth from melts

68419 **An analysis of the derivative weight-gain signal from measured crystal shape: implications for diameter control of GaAs.** li, A.S.Jordan, R.Caruso, A.R.von Neida (Bell Labs., Murray Hill, NJ, USA).
Bell Syst. Tech. J. (USA), vol.62, no.2, pt.1, p.477-98 (Feb. 1983).
The authors model a diameter control scheme based on the monitoring of crystal weight for liquid-encapsulated Czochralski (LEC) growth of GaAs. The presence of the B_2O_3 liquid encapsulant and significant capillary forces make the direct interpretation of the weight-gain signal and its time derivative (DWGS) more complicated in comparison with pulled materials such as oxide crystals. The authors formulate a realistic model for the LEC growth of axisymmetric crystals and derive the differential equation relating the time evolution of the DWGS to radius and length. They show that the magnitude of the DWGS at the crystal's 'shoulder' is inversely related to the radius of curvature. (22 refs.)

68420 **On iodine behaviour in bulk crystals of PbTe and SnTe synthesized by the iodide method.** E.P.Trifonova, L.Karagiozov (Sofia Univ., Sofia, Bulgaria).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.315-20 (1983).
In order to explain the peculiar characteristics of iodidely synthesized PbTe and SnTe crystals a model for their interaction with iodine is suggested. It is based on the assumption that PbI and I, respectively SnI, and I, resulting from the PbI_2 (SnI_2) dissociations, are incorporated independently and specifically in the crystals: in PbTe prevails the PbI-incorporation; in SnTe—the incorporation of $I+V_{Sn}$. The difference is connected with the thermodynamic stability of the PbTe and SnTe crystal lattices. (12 refs.)

68421 **Composition control in proton-exchanged $LiNbO_3$.** J.L.Jackel, C.E.Rice, J.J.Veselka (Bell Labs., Holmdel, NJ, USA).
Electron. Lett. (GB), vol.19, no.10, p.387-8 (12 May 1983).
The amount of hydrogen in $Li_{1-x}H_xNbO_3$ layers prepared by proton exchange of $LiNbO_3$ in benzoic acid melts can be limited by adding lithium compounds to the melt. Limiting exchange prevents surface damage, a problem primarily affecting *y*-cut substrates, and reduces scattering in exchanged guides. (4 refs.)

68422 **Experimental study of the temperature distributions in white sapphire single crystals.** Yu.K.Lingart, V.A.Petrov (High-Temperature Inst., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.606-12 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.725-32 (July-Aug. 1982). [received: April 1983]
Measurements have been made on the temperature fields (T fields) directly in the growth of single crystals of platy white sapphire. Features of the T-field formation are demonstrate that are related to the partial transparency of the material to the thermal radiation. (13 refs.)

68423 Preparation of TlP_xS_{1-x} and investigation of physicochemical properties. S.S.Sitamov, S.K.Karimov (Kulyab State Pedagogical Inst., Kulyab, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.745-9 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.891-4 (June 1982). [received: Feb. 1983]
A two-temperature synthesis method was used to obtain TlPS, which is greenish gray and has a microhardness of 2×10^9 Pa and a density of 5.6 g/cm^3. Differential-thermal tensimetry, X-ray phase analysis, and microstructure analysis were used in studying solid solutions TlP_xS_{1-x}, and the individuality of existence of the compound TlPS was confirmed. In an investigation of the temperature dependence of the magnetic susceptibility of TlPS in the solid and liquid states, it was shown that this compound has diamagnetic properties and that its transition to the liquid state is of the 'semiconductor-semiconductor' type. (13 refs.)

68424 Synthesis of chalocgenides with the composition $A^I_2B^{VI}$ and crystal structure of Rb_2Te_3 and Cs_2Te_3. K.A.Chuntonov, A.N.Orlov, S.P.Yatsenko, Yu.N.Grin', L.D.Miroshnikova (Inst. of Chem., Acad. of Sci., Sverdlovsk, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.941-3 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1113-16 (July 1982). [received: Feb. 1983]
Single crystals of Rb_2Te_3, Rb_2Se_3, Cs_2Te_3, and Cs_2Se_3 were grown by the Bridgman-Stockbarger method. The crystal structures of Rb_2Te_3, Rb_2Se_3, and Cs_2Te_3 were decoded on the basis of data obtained for powders and single crystals. The first compound crystallizes in a structure of the K_2Te_3 type, while the remaining compounds have the K_2S_3 structure. (6 refs.)

68425 Preparation of strontium tellurite single crystals. A.M.Antonenko, A.Yu.Kudzin, L.Ya.Sadovskaya (Dnepropetrovsk State Univ., Dnepropetrovsk, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.1022-4 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1213-16 (July 1982). [received: Feb. 1983]
The amount of tellurates formed during the growing of strontium tellurite crystals is insignificant. Owing to the high volatility of tellurium dioxide the crystals grow in an atmosphere of TeO_2 vapor. Since the existence of a phase transition at 1293K complicates the crystallization the optimum composition of the initial charge for preparing $SrTeO_3$ crystals is one containing a 20% excess of paratellurate. (10 refs.)

68426 Bridgman growth of Rb_2MnCl_4 via accelerated crucible rotation technique. A.Horowitz, D.Gazit, J.Makovsky (Nuclear Res. Center Negev, Beersheva, Israel), L.Ben-Dor.
J. Cryst. Growth (Netherlands), vol.61, no.2, p.323-8 (March 1983).
The Accelerated Crucible Rotation Technique (ACRT) was applied to the Bridgman growth of incongruently melting Rb_2MnCl_4 from non-stoichiometric melts. ACRT mixing allowed the increase of the crystal growth rates by a factor of four compared to the maximum growth rate, in order to obtain inclusion-free crystals, without stirring. The existing analytical data do not allow a prediction of the optimum ACRT parameters and it is possible that even higher growth rates could still be achieved. The ACRT-induced changes of the fluid flow velocity past the growing face and of the thickness of the diffusion boundary layer were calculated. (15 refs.)

68427 Heat transfer analysis of the Bridgman-Stockbarger configuration for crystal growth. I. Analytical treatment of the axial temperature profile. T.Jasinski, W.M.Rohsenow (Dept. of Mech. Engng., MIT, Cambridge, MA, USA), A.F.Witt.
J. Cryst. Growth (Netherlands), vol.61, no.2, p.339-54 (March 1983).
An analytical approach describing the heat transfer during crystal growth in a Bridgman-Stockbarger configuration has been developed. All first order effects on the axial temperature distribution in a solidifying charge are treated on the basis of a one-dimensional model whose validity could be verified through comparison with a published finite difference analysis of a two-dimensional model. The present model includes an insulated region between axially aligned heat pipes and considers the effects of a two-dimensional model. The present model includes an insulated region between axially aligned heat pipes and considers the effects of charge diameter, charge motion, thickness and thermal conductivity of a confining crucible, thermal conductivity change at the crystal-melt interface and non-infinite charge length. Results are primarily given in analytical form and can be used without recourse to computer work for both improved furnace design and optimization of growth conditions in a given thermal configuration. (8 refs.)

68428 The formation of $CuInSe_2$ from the elements. G.Kuhn, U.Boehnke (Sektion Chem., Karl-Marx-Univ., Leipzig, Germany).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.415-16 (March 1983).
From powder X-ray diffraction analysis and DTA experiments it was found that in the temperature range from 220 to 320°C most of the heat of reaction is due to the interaction of liquid In and liquid or gaseous Se. The ternary compound $CuInSe_2$ always begins to form at temperatures below 300°C. (10 refs.)

68429 Dislocation-free GaAs and InP crystals by isoelectronic doping. G.Jacob, M.Duseaux, J.P.Farges, M.M.B.van den Boom, P.J.Roksnoer (Labs. d'Electronique et de Phys. Appl., Limeil-Brevannes, France).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.417-24 (March 1983).
The influence of isoelectronic doping on the properties of LEC GaAs and InP crystals has been studied. These crystals exhibit the usual electrical properties. A decrease of the dislocation density is obtained using In and Sb as dopants in GaAs crystals, and Sb. As and Ga As dopants in InP crystals. GaAs:In crystals in the range of 20-35 mm diameter and 100-300 g in weight have been obtained nearly dislocation free. (12 refs.)

68430 Three ways of growing undoped semi-insulating GaAs single crystals. M.Bonnet, N.Visentin, B.Lent, C.Raffet (Lab. Central de Recherches, Thomson-CSF, Orsay, France).
Rev. Tech. Thomson-CSF (France), vol.15, no.1, p.39-57 (March 1983). In French.
Describes three different ways of obtaining large-diameter (50-80 mm) undoped semi-insulating GaAs single crystals intended for ion implantation in the manufacture of integrated circuits. Semi-insulating crystals may be obtained by growing from quartz crucibles and either adjusting the moisture content of the encapsulant, or adding gallium oxide to melt, or, alternatively, by growing from boron nitride crucibles. The electrical properties show that in all three cases it is possible to have a resistivity higher than 10^7 Ω cm, coupled with mobility better than 4000 $cm^2.V^{-1}.s^{-1}$. The authors show the effect which the moisture content of the encapsulation and the stoichiometry of the liquid have on the longitudinal homogeneity of the crystal's properties. In addition, chemical analyses make it possible to assert that there is only a small concentration of the main impurities ($<10^{16}$ at.cm^{-3}). (12 refs.)

Conditions for the preparation and subsequent crystallization of amorphous alloys of the Ge-Te system .... See Entry 66832

Plastic bend in a growing crystal .... See Entry 66905

The melt growth of semicircular crystals of the pure Pb and its dilute alloys .... See Entry 66906

Kinetics of crystal growth under conditions of low solubility of a crystal-forming substance in a matrix .... See Entry 66910

The influence of growth conditions on strains in YAG crystals .... See Entry 66917

Solidification of the Al-In monotectic alloy in a horizontal Bridgman configuration. I. Experimental aspects and structure characterisation .... See Entry 67172

Vacancy centers in single crystals in $Bi_{12}RO_{20}$(R=Si, Ti, Ge) .... See Entry 68016

Evaluation of the spin-up time during the accelerated crucible rotation technique .... See Entry 68418

81.10J Growth from solid phases

(inc. multiphase diffusion and recrystallisation)

68431 Microstructure and mechanisms for recrystallization in polycrystalline PbTe samples. Yu.D.Titarenko, E.P.Sabo, N.I.Grechko.
Inorg. Mater. (USA), vol.18, no.6, p.793-5 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.946-8 (June 1982). [received: Feb. 1983]
The quantitative characteristics of the microstructure of polycrystalline PbTe samples obtained by low-temperature pressing (at <450°C) are a factor of the particle size of the starting powder. Recrystallization in the samples during heat treatment proceeds by an in situ mechanism. The microstructure of samples pressed at ≥600°C is independent of the particle size of the starting powder and is determined by the pressing temperature and pressure. Recrystallization in these samples proceeds by a collective mechanism and subsequent heat treatment does not alter the quantitative characteristics of the microstructure. (5 refs.)

68432 Growth of $Cd_{1-x}M_xCr_2Se_4$ single crystals (M=In, Al, Ag, Cu) by chemical transport reaction method. A.I.Merkulov, S.I.Radautsan, V.E.Teelevan, R.Yu.Lyalikova (Inst. of Appl. Phys., Acad. of Sci., Moldavian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.816 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.973-5 (June 1982). [received: Feb. 1983]
Conditions have been determined for the growth of $CdCr_2Se_4$ single crystals doped with various impurities over a wide range of concentrations, these crystals being grown by the chemical transport reaction method. It has been shown that indium or aluminium accelerates the mass transport rate, and silver or copper retards the rate. (7 refs.)

68433 Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$. I.V.Bondar' (Inst. of Solid State Phys. & Semiconductors, Acad. of Sci., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.934-7 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1104-7 (July 1982). [received: Feb. 1983]
Single crystals of the ternary compounds $CuAlSe_2$ and $CuGaSe_2$ are grown by means of chemical transport reactions. The microstructure and microhardness of the crystals are investigated. The unit-cell parameters, melting points, and forbidden-band widths are determined at 77K and 300K in polarized light. (11 refs.)

68434 Synthesis and physical properties of $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$. I.O.Troyanchuk, A.A.Samokhvalov, T.I.Arbuzova, B.A.Gizhevskii, V.S.Babushkin, L.A.Bashkirov, A.K.Bogush, L.V.Balyko, V.B.Shipilo (Inst. of Solid State Phys. & Semiconductors, Acad. of Sci., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.1025-8 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1217-21 (July 1982). [received: Feb. 1983]
In solid solutions $Ca(Cu_{1-x}Mn_x)_3Mn_4O_{12}$ with a perovskite-like structure, the parameter of the cubic unit cell varies linearly with the value of x from 7.210 Å at x=0 to 7.338 Å at x=0.82. When 20% of the copper is replaced by manganese (x=0.2), the Curie point remains practically unchanged, remaining at (350±5)K, but the saturation magnetization increases. With higher Mn^{3+} ion contents in the C sublattice, these parameters appreciably decrease. The compositions under investigation are semiconductors with high carrier concentration and low carrier mobility. (3 refs.)

Lateral dopant transport during laser recrystallization of polysilicon .... See Entry 67041

Magnetic susceptibility of $La_{1-x}Nd_xTlO_3$ system ($0.0\leq x\leq1.0$) [and synthesis and X-ray characterisation] .... See Entry 67899

81.15 METHODS OF THIN FILM DEPOSITION

(inc. epitaxial growth methods; see also 68.55 Thin film growth, structure, and epitaxy)

68435 Stick-on cobalt oxide selective coatings for solar thermal applications. C.Choudhury, D.S.Hrshikesan, H.K.Sehgal (Dept. of Phys., Indian Inst. of Technol., New Delhi, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.821-3 (Oct. 1982). [received: April 1983]
Investigations carried out on spray deposited cobalt oxide selective coatings grown on aluminium foils and mounted on commercial galvanized iron sheets are found to have photo-thermal conversion efficiencies comparable with those of the films grown directly on commercial galvanized iron substrates. Optimum selective performance was obtained for films grown at ~190°C on aluminium foils. Optimized films were observed to be ~0.117 μm thick and have $\alpha=0.85$ and $\varepsilon_{100C}=0.125$. Accelerated life tests indicate that these films have good adhesion to the substrates and stable performance characteristics under dry and humid environments. (9 refs.)

68436 The growth of submicron eutectic thin film structures. H.E.Cline (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.217-30
As the minimum dimension of electronic circuits is reduced below one micron, there has been increased interest in developing techniques for fabricating submicron structures. Pb-Sn, Cd-Pb and Al-Al_2Cu eutectic thin films were directionally solidified at rates between 0.0015 cm/sec and 0.15 cm/sec with both a lamp and a laser heat source to fabricate fault free submicron periodic structures. A transition from lamellar to cellular structures with increasing

solidification rate was observed with a thermal gradient of 200°C/cm applied with the lamp heat source. Cells did not form with the increased thermal gradient produced by the laser heat source, 8000°C/cm. Spacings as fine as 0.1 micron were observed in the Cd-Pb eutectic. A maximum theoretical growth rate was estimated which corresponds to a spacing of 80 A. (21 refs.)

Effects of ion implantation on the thermal growth of Pt and NiPt silicides ....See Entry 67400

The leap from conventional to high energy plasma spraying ....See Entry 68686

81.15C Deposition by cathodic sputtering

68437 Highly oriented zinc oxide films. I.M.Grankin, G.I.Kal'naya, N.M.Prishchepa (Fiftieth Anniversary of the Great October Revolution Kiev Polytech. Inst., Kiev, Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.5, p.689-92 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.820-4 (May 1982). [received: Feb. 1983]
Conditions were found for the preparation of unstrained, stoichiometric, highly dispersed zinc oxide films with a close-to-normal orientation of the crystallite c-axes relative to the base using combined sputtering and heat treatment. (9 refs.)

68438 Low temperature deposition of silicon nitride by reactive ion-beam sputtering. D.Bouchier, G.Gautherin, C.Schwebel, A.Bosseboeuf (Inst. d'Electronique Fondamentale, Univ. Paris XI, Orsay, France), B.Agius, S.Rigo.
J. Electrochem. Soc. (USA), vol.130, no.3, p.638-44 (March 1983).
The deposition mechanism of reactive ion beam sputtered silicon nitride was studied. Using RBS analysis, the composition of Si_xN_y layers deposited at room temperature has been investigated as a function of different parameters. Irrespective of the nitrogen partial pressure, ranging from 10^{-4} to 0.2 Pa, the stoichiometry of the film depends only on the sputtering yield of silicon in the range 0.4-20 keV. Si_3N_4 layers can be obtained at low voltage, but only with a low deposition rate (typically 1 nm/min at the authors experimental conditions). In order to obtain Si_3N_4 films with higher deposition rates, the author increased the nitridation of deposited silicon, either by introducing in the deposition chamber of a highly reactive molecule such as NH_3, or by using electronic bombardment, which stimulates the adsorption of N_2 on the growing film. (28 refs.)

Electron microscope study of defects in epitaxial layers of silicon carbide ....See Entry 67395

Amorphous silicon-carbon-fluorine alloy films ......See Entry 67689

Some properties of reactively sputtered tin lead oxide films .... See Entry 68351

Transparent conducting layers, their preparation and utilisation ....See Entry 68446

Recent advances in ITO/InP and Cds/InP solar cells ......See Entry 68889

81.15G Vacuum deposition

68439 Effects of very low growth rates on GaAs grown by molecular beam epitaxy at low substrate temperatures. G.M.Metze, A.R.Calawa (Lincoln Lab., MIT, Lexington, MA, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.818-20 (1 May 1983).
Molecular beam epitaxy of GaAs is conventionally performed at growth rates of ~1 μm/h. For growth rates in this range, donor-doped films grown at substrate temperatures below 500°C have low carrier concentrations and high resistivities. The authors have grown Si-doped films with good electrical properties at substrate temperatures of 380 and 450°C by reducing the growth rates to ~0.02 and 0.2 μm/h, respectively. They believe that the improvement can be attributed to a reduction in the concentration of crystal defects, which occurs because the Ga and As atoms adsorbed on the substrate surface have sufficient time to reach appropriate lattice sites before they are incorporated into the growing film. (9 refs.)

68440 Electrical and photo-luminescence properties of ZnSe thin films grown by molecular beam epitaxy: substrate temperature effect. T.Yao, M.Ogura, S.Matsuoka, T.Morishita (Electrotech. Lab., Ibaraki, Japan).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L144-6 (March 1983).
The substrate temperature effect on electrical and PL properties of undoped MBE ZnSe has been investigated. Resistivity (ρ) of the epilayers shows an abrupt change with the substrate temperature (T_s): $\rho \sim 10^6$ ohm-cm for $T_s \sim 250°C$ or $\gtrsim 400°C$, while $\rho \sim 1$ ohm-cm for $280°C \lesssim T_s \lesssim 370°C$. The substrate temperature dependence of PL spectra of the epilayers reveals that (1) the high resistivity is caused by the increase of the SA centers above 400°C and below 250°C, and (2) the diffusion of As and Ga from the GaAs substrate occurs during the growth process.

68441 Effect of various plasmas on vacuum deposited amorphous and microcrystal silicon. P.H.Fang, Zhong Huan, Yinqun Gao, C.C.Schubert, J.H.Kinnier (Dept. of Phys., Boston Coll., Chestnut Hill, MA, USA).
Jpn. J. Appl. Phys. Part 2 (Japan), vol.22, no.3, p.L147-8 (March 1983).
A gaseous plasma of oxygen, nitrogen, hydrogen and air has been used to treat amorphous and microcrystal silicon. The resultant effect, as measured by the photovoltaic characteristics of solar cells made of these materials, is that all of these gases can be effectively incorporated into the amorphous and microcrystal silicon to produce a beneficial photovoltaic effect. There is some difference in thermal stability; nitrogen is very similar to hydrogen and is higher in stability, and oxygen and air are somewhat lower. (10 refs.)

68442 GaAs vapour phase epitaxy on curved surfaces. B.P.Jain, K.Chand, I.Chandra, B.L.Sharma (Solid State Phys. Lab., Delhi, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.824-5 (Oct. 1982). [received: April 1983]
Vapour phase epitaxy of GaAs has been carried out on concave spherical and concave cylindrical GaAs substrates using $AsCl_3$-Ga-H_2 open-tube system. The experimental set-up used for preparing curved surfaces is briefly discussed. The growth parameters on the curved surface and the surface morphology of deposited layers have been investigated, using the techniques of optical and scanning electron microscopy. (2 refs.)

68443 Binary metal alloys obtained by vacuum evaporation and condensation. A.A.Babad-Zakhryapin, R.Kh.Zhalilov.
Inorg. Mater. (USA), vol.18, no.6, p.819-21 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.976-8 (June 1982). [received: Feb. 1983]
The Ni+Cr, W+Mo, $W+Al_2O_3$, and $Cr+Cr_2O_3$ binary metallic coats obtained by vacuum evaporation and condensation were studied. The coats were found to have a lamellar structure, including the W+Mo alloy at a deposition temperature of 1300K. Laminated coats are formed when two phases appear in the process of their growth. It was shown that the observed structures of the coats obtained by vacuum condensation of vapours and decomposition of vapours of volatile compounds are practically the same. (6 refs.)

68444 Effect of arsenic dimer/tetramer ratio on stability of III-V compound surfaces grown by molecular beam epitaxy. C.E.C.Wood, C.R.Stanley, G.W.Wicks, M.B.Esi (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA).
J. Appl. Phys. (USA), vol.54, no.4, p.1868-71 (April 1983).
Using a post-effusion thermal cracking furnace, the 'arsenic stabilization' efficacy of As_2 versus As_4 on the surfaces of (100) GaAs, $Al_{0.48}In_{0.52}As$,s $Ga_{0.47}In_{0.53}As$ and $(AlGa)_{0.47}In_{0.53}As$ has been studied. Dimers were found to be no more efficient than tetramers either slightly below, at, or above the upper congruent sublimation temperature. (17 refs.)

68445 Extremely uniform GaAs-AlGaAs heterostructure layers with high optical quality by molecular beam epitaxy. T.Fujii, S.Hiyamizu, O.Wada, T.Sugahara, S.Yamakoshi, T.Sakurai, H.Hashimoto (Fujitsu Ltd., Kawasaki, Japan).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.393-6 (March 1983).
The authors describe experiments in which the light output of molecular beam epitaxy (MBE) grown GaAs-AlGaAs LED's varied less than 3.5%. Also the threshold current density (J_{th}) of a MBE-grown GaAs-AlGaAs double-heterostructure laser was only 870 A/cm^2. Such extremely uniform radiance and low J_{th} show the superiority of MBE over other epitaxial growth techniques which might be applicable to integrated optics. (9 refs.)

68446 Transparent conducting layers, their preparation and utilisation. F.Pribyl.
Slaboproudy Obz. (Czechoslovakia), vol.44, no.3, p.140-2 (March 1983). In Czech.
Three main technologies of depositing transparent conducting layers based on Sn, In and Cd oxides or their combinations are dealt with: pyrolytic deposition of chlorides, cathode sputtering and vacuum evaporation. Methods of etching are also discussed including the plasma etching technology. Electrical and optical properties of the fabricated layers are briefly dealt with and their adhesive capacity is discussed. (3 refs.) *E.D.*

A combined vacuum interlock and preparation assembly for MBE and surface analysis ...... See Entry 64914

GaAs (001)-c(4×4): a chemisorbed structure ......See Entry 67353

Dynamics of film growth of GaAs by MBE from RHEED observations ....See Entry 67383

Surface mobility of silver and gold on evaporated silver bromide layers ....See Entry 67401

Effects of MBE growth conditions on carbon contamination in GaAs ....See Entry 67406

Anisotropic properties and structure of amorphous films of selenium ....See Entry 67410

Core-level photoemission studies of MBE-grown semiconductor surfaces ....See Entry 67728

Cermets of Cu-PbI_2 thin layers: fabrication and determination of optical constants ......See Entry 68146

Optical properties of codeposited aluminum-silicon composite films ....See Entry 68338

81.15H Chemical vapour deposition

68447 Laser induced deposition of zinc oxide. R.Solanki, G.J.Collins (Engng. Res. Center, Colorado State Univ., Fort Collins, CO, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.662-3 (15 April 1983).
The authors have used an excimer laser to photodeposit uniform (±5%) films of zinc oxide from dimethylzinc and nitrogen dioxide. Deposition rates of 3000 Å/min over 2 cm×5 areas were obtained. They have measured the stress, refractive index, etch rate, adhesion, pinhole density, and the stoichiometry of these photodeposited films. (18 refs.)

68448 Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition. T.Saitoh, S.Muramatsu, T.Shimada, M.Migitaka (Central Res. Lab., Hitachi Ltd., Tokyo, Japan).
Appl. Phys. Lett. (USA), vol.42, no.8, p.678-9 (15 April 1983).
Amorphous silicon films have been prepared through mercury-photosensitized decomposition of monosilane gas at low temperatures. The films show optical and electrical properties comparable with those of the best films prepared by plasma chemical vapor deposition. The feasibility of amorphous solar cells with short-circuit current densities of more than 10 mA/cm^2 has been demonstrated by fabrication of a Schottky barrier structure. (6 refs.)

68449 Crystallization of amorphous silicon films during low pressure chemical vapor deposition. E.Kinsbron, M.Sternheim, R.Knoell (Bell Labs., Murray Hill, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.835-7 (1 May 1983).
The crystallization of low pressure chemical vapor deposition amorphous silicon films was studied by transmission electron microscope observations. The results demonstrate the interdependence of the silicon deposition rate, the incubation time for nucleation, and the crystalline growth rate. At temperatures below 600°C the deposited films are amorphous, but partial crystallization can occur if the deposition time is longer than the incubation time. Crystallization occurs through an epitaxial-like growth from nucleates near or at the substrate interface; the crystalline phase will reach the depositing interface for thick films if the growth rate exceeds the deposition rate. The crystallized fraction of the deposited layer can be controlled by regulating the deposition temperature and rate and by in situ addition of dopant impurities. At temperature higher than 600°C the deposited films are polycrystalline and columnar in structure. The surface texture is much smoother for films whose surfaces are amorphous. (23 refs.)

68450 On batch homogeneity in horizontal CVD reactors. I. Model of heating the process gas. F.Richter (Inst. fur Phys. der Werkstoffbearbeitung, Akad. der Wissenschaften, Berlin, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.551-62 (1983).
A model of heating of the process gas during its flow along the heater is given as an attempt to describe the batch homogeneity with layer deposition and gas phase etching processes in horizontal CVD-reactors. An analytical expression is derived for the resulting longitudinal temperature profile $T(x)$ dependence of the gas properties, susceptor temperature, geometric parameters of the reactor, and gas flow rate. (7 refs.)

68451 Laser induced chemical vapor deposition of Ni by decomposition of $Ni(CO)_4$. W.Krauter, D.Bauerle, F.Fimberger (Angewandte Phys., Johannes-Kepler-Univ., Linz, Austria).
Appl. Phys. A (Germany), vol.A31, no.1, p.13-18 (May 1983).
Polycrystalline Ni has been grown by decomposition of $Ni(CO)_4$ using different wavelengths of the visible radiation of a Kr^+ laser. The influence of laser

irradiance, substrate material and scanning velocity on deposition rate and widths of patterns has been investigated. The deposition rates achieved are typically several μm/s, and the lateral dimensions of the deposits can be as small as 1 μm. (9 refs.)

68452 Possibilities and limitations for the application of CVD-coated cemented carbide tools and steel tools. W.Schintlmeister, J.Kanz, W.Wallgram (Metallwerk Plansee GmbH, Reutte, Austria).
Int. J. Refract. & Hard Met. (GB), vol.2, no.1, p.41-3 (March 1983).
Important wear characteristics of hard coatings and the influence of the coating on the toughness of the tools are described. From this, the application possibilities and limitations for CVD coated tools are deduced. In addition to the applications for coated hardmetal tooling for tuning, special coatings for milling and for chipless forming are described. With regard to coated steel tooling the most important application examples as well as the limitations, particularly with respect to heat treatment, are referred to. Finally, a brief description of an economic and efficient production coating unit is outlined. (7 refs.)

68453 Growth of epitaxial CdTe films in the $Cd(CH_3)_2$-$(CH_3)_2Te$-H_2 system. P.I.Kuznetsov, L.A.Zhuravlev, I.N.Odin, V.V.Shemet, A.V.Novoselova (Inst. of Radioengng. & Electronics, Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.779-83 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.930-4 (June 1982). [received: Feb. 1983]
Epitaxial CdTe layers on CdS(0001)S and muscovite mica supports were obtained by gas-phase chemical deposition in the $Cd(CH_3)_2$-$(CH_3)_2Te$-H_2 system. Electron-diffraction analysis and microscopic investigations of the film surface morphology and crystal structure were performed. The dependence of CdTe film growth rates on the support temperature, component concentration in the vapor-gas mixture, and hydrogen consumption was determined. The optimal regime for the growth of monocrystalline CdTe films was established. It was found that CdTe films are highly resistive and their absorption spectra contain exciton lines. (8 refs.)

68454 Deposition and properties of zinc phosphide films. T.L.Chu, S.Chu, K.Murthy, E.D.Stokes (Southern Methodist Univ., Dallas, TX, USA), P.E.Russell.
J. Appl. Phys. (USA), vol.54, no.4, p.2063-8 (April 1983).
Thin films of zinc phosphide have been deposited on tungsten-coated steel substrates at 400-600°C by the reaction of zinc and phosphine in a hydrogen atmosphere; tungsten was used as a barrier against the diffusion of iron from the substrate into zinc phosphide. By using a proper PH_3/Zn molar ratio, the deposited films have been identified by electron microprobe and X-ray diffraction techniques to be Zn_3P_2. The electrical resistivity and photovoltage of unintentionally doped zinc phosphide films were measured as a function of the composition of the reaction mixture. The effective intragrain minority carrier diffusion length in nearly stoichiometric films was measured by the scanned beam method using a Schottky barrier structure. The incorporation of dopants into zinc phosphide films was also explored. (10 refs.)

68455 The growth of Zn_3P_2 by metalorganic chemical vapor deposition. J.Long (Bell Labs., Murray Hill, NJ, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.725-8 (March 1983).
The growth of undoped, polycrystalline Zn_3P_2 by the method of metalorganic chemical vapor deposition has been demonstrated and the growth characteristics determined as a function of growth conditions. The quality of the layers was observed to be highly dependent on the substrate material. The samples growth on graphite exhibited microcracks due to a mismatch of the thermal expansion coefficient of Zn_3P_2 with that of the graphite. This problem was eliminated by use of mica or silicon steel as the substrate. (4 refs.)

68456 Alloying mechanisms in MOVPE $GaAs_{1-x}$. L.Samuelson, P.Omling, H.G.Grimmeiss (Dept. of Solid State Phys., Univ. of Lund, Lund, Sweden).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.425-6 (March 1983).
Novel experimental and analysis approaches are presented for the extraction of crucial data for vapour phase and surface chemistry mechanisms governing the solid phase composition of alloys. Applied to MOVPE of $GaAs_{1-x}P_x$, an activation energy of $E_A \approx 1$ eV (23 kcal/mole) for the As/P competition on the group V sub-lattice is deduced. (4 refs.)

68457 Low-pressure metalorganic chemical vapor deposition of InP, GaInAs and GaInAsP. M.Razeghi (Lab. Central de Recherches, Thomson-CSF, Orsay, France).
Rev. Tech. Thomson-CSF (France), vol.15, no.1, p.59-86 (March 1983). In French.
Low pressure MOCVD epitaxial growth is used for the growth of: 1. the entire composition range of $Ga_xIn_{1-x}As_yP_{1-y}$ ($0.47 \leq x \leq 0$ and $0 \leq y \leq 1$) uniform composition lattice matched to InP over an area of 10 cm^2; 2. nonintentionally doped InP with $N_D - N_A = 6 \times 10^{14}$ cm^{-3}, $\mu(300) = 5300$ cm^2.V^{-1}.s^{-1}, $\mu(77) = 58000$ cm^2.V^{-1}.s^{-1}; 3. nonintentionally doped $Ga_{0.47}In_{0.53}As$ with $N_D - N_A = 2 \times 10^{15}$ cm^{-3}: $\mu(300) = 12000$ cm^2.V^{-1}.s^{-1}, $\mu(77) = 60000$ cm^2.V^{-1}.s^{-1} and $\mu(2) = 90000$ cm^2.V^{-1}.s^{-1}; 4. the first reported growth of $GaAs_{0.47}In_{0.53}As$/InP superlattice. The compositional grading at both interfaces of InP/GaInAs/InP extending over a region less than 60 Å thick; 5. the first observation of a two dimensional gas of high mobility electrons at the interface of a GaInAs/InP heterojunction; 6. the formation of good quality GaInAsP/InP double heterostructures for laser applications. (16 refs.)

68458 General computer simulation formulae of low pressure chemical vapor deposition. Wang Jitao (Dept. of Phys., Fudan Univ., Shanghai, China).
Sci. Sin. (China), vol.26, no.3, p.273-83 (March 1983).
Recently, the technique of low pressure chemical vapor deposition (LPCVD) has been used extensively in semiconductor industry because of its extremely favorable economics. Its theoretical work, however, has rarely been reported. After deriving computer simulation formulae of LPCVD poly-Si films, a set of general computer simulation formulae are derived, which are used successfully in the computer simulation for LPCVD SiO_2 and Si_3N_4. This shows the theoretical simulation method is generally conformable to the technology of LPCVD. Some new rules have been obtained theoretically. They are in favor of improving the technique of LPCVD and of optimizing the design of LPCVD equipments. (7 refs.)

68459 Nitrogen activation for plasma chemical synthesis of thin Si_3N_4 films. L.Bardos, J.Musil, P.Taras (Inst. of Plasma Phys., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Thin Solid Films (Switzerland), vol.102, no.2, p.107-10 (15 April 1983).
The authors summarize a study of the reactions of plasma-activated nitrogen with silane and NO admixture during the plasma-enhanced chemical vapour deposition (PECVD) of Si_3N_4 films outside the plasma region. The dominant role of nitrogen atoms, mainly in the ground (^4S) state, was demonstrated experimentally. Probable chemical processes in the PECVD zone are discussed. (8 refs.)

68460 Theoretical influence of the chemical vapour deposition processes on the thickness and structural uniformity of the deposits. L.Vandenbulcke (Centre de Recherches sur la Chimie de la Combustion et des Hautes Temperatures, Orleans, France).
Thin Solid Films (Switzerland), vol.102, no.2, p.149-60 (15 April 1983).
A mass transfer-surface kinetics model allows a study to be made of the relative importance of gas phase diffusion and surface kinetics. It provides a method of predicting the uniformity and morphology of deposits as functions of the supersaturation at the gas-solid interface. A simple geometry is used in which the direction of the gas flow is parallel to a flat deposition surface but the results can be extended to other geometries and large-scale reactors as the dual influence of the depletion of reactants and the variation in the boundary layer thickness along the surface occurs. Uniformity of the thickness and the structure is predicted when the supersaturation is high, at low pressure, low temperature and high gas flow rate. At low supersaturation and in intermediate conditions it appears that careful attention to the gas flow pattern is necessary to obtain uniform deposits. Calculations are carried out for the B-H-Cl system but the results can be extended to the deposition of various materials. (31 refs.)

Twin-channel substrate-mesa-guide injection lasers fabricated by organometallic vapor phase epitaxy .... See Entry 66272
A decisive state for laser diodes .... See Entry 66278
The application of 'organometallic' technology to the growth of GaAs/GaAlAs laser structures .... See Entry 66297
Composition of the gas phase in the Cd-Te-N-H-I system ...... See Entry 66663
The influence of an external electric field on the silicon homoepitaxy process .... See Entry 67385
Deposition of GaAs epitaxial layers by organometallic CVD. Temperature and orientation dependence .... See Entry 67399
Structure of indium tin oxide electrodes on zirconia .... See Entry 67411
On the origin of free-carriers in high-conducting n-GaN .... See Entry 67586
Modulation doped GaAs-$Ga_{1-x}Al_xAs$ heterostructures grown by atmospheric pressure MOVPE .... See Entry 67758
Regulation of mass transfer in a zinc selenide-hydrogen-inert gas transport system .... See Entry 68414
Mechanism of pyrolysis of monosilane at reduced pressure ..... See Entry 68766
Compositional depth profile of a native oxide LPCVD MNOS structure using X-ray photoelectron spectroscopy and chemical etching ....See Entry 68837

81.15J Ion plating and other vapour deposition

68461 Growth of hydrogenated amorphous silicon due to controlled ion bombardment from a pure silane plasma. B.Dervillon, J.Perrin, J.M.Siefert, J.Huc, A.Looret, G.de Rosny, J.P.M.Schmitt (LPNHE, Ecole Polytech., Palaiseau, France).
Appl. Phys. Lett. (USA), vol.42, no.9, p.801-3 (1 May 1983).
The growth process, optical and structural properties of *a*-Si:H films deposited from a silane multipole DC discharge are analyzed by a real time and spectroscopic ellipsometry, and IR absorption spectroscopy. Films deposited mainly from neutral polymerized species are systematically compared to films deposited from monomeric ionic species at various ion incident energy up to 100 eV. An increase of ion bombardment energy is shown to favor the formation of high density homogeneous and isotropic films. (14 refs.)

68462 Optimum geometry of high-voltage electrodes in conditions of vapour condensation. M.K.Bologa, I.K.Savin, A.B.Didkovskii.
Elektron. Obrab. Mater. (USSR), no.1, p.58-61 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
The results are given of investigations aimed at determining the optimum design of high-voltage electrodes and the inter-electrode distance in conditions of condensation of clean vapour and in the presence of a non-condensing gas. Because of the difference in the decisive thermal resistances in these heat-exchange processes, the choise of electrode geometry also appeared to be substantially diverse. In conditions of condensation of clean vapour the use of solid electrodes perforated with vertical slots is recommended, whilst corona-discharging wire electrodes are recommended for use in condensing vapour of steam-gas mixtures. (7 refs.) *A.J.B.*

Decreased losses in germanium-oxide glass optical fiber prepared by VAD method .... See Entry 66393
Mass transfer of iron during doping of epitaxial layers of gallium arsenide .... See Entry 67022
Epitaxial growth of tungsten and tungsten-rhenium alloys from the gas phase .... See Entry 67389
Electrical properties of $AgGaSe_2$ epitaxial layers .... See Entry 67809
Hard carbon coatings with low optical absorption .... See Entry 68340
Compositional characterization of microwave plasma a-Si:H films .... See Entry 68817

81.15L Deposition from liquid phases (melts and solutions)

68463 Liquid phase epitaxy of $Ga_xIn_{1-x}As_yP_{1-y}$. J.Ricciardi, B.de Cremoux (Lab. Central de Recherches, Thomson-CSF, Orsay, France).
Rev. Tech. Thomson-CSF (France), vol.15, no.1, p.87-137 (March 1983). In French.
Having recalled the underlying principle of epitaxial growth in the liquid phase, the authors review the different models for calculating the phase diagram of the quaternary material $Ga_xIn_{1-x}A_yP_{1-y}$ used for optical communciations for wavelengths of 1.2 to 1.6 μ. The dynamic growth model already established for III-V binary materials is extended to quaternary materials. The experimental results that are indicated make it possible to refine the theoretical phase diagram and to verify the laws which the growth regime obeys. (31 refs.)

A radioisotope method of thickness measurement for rhodium plating on rings .... See Entry 64888
Morphogenetic aspects of the LPE heterostructure growth: time evolution of configuration entropy .... See Entry 67379
Stabilization of the melt composition in Ga-Al-Sb-As .... See Entry 67380
Effect of lattice mismatch on the solidus compositions of $Ga_xIn_{1-x}P$ liquid phase epitaxial crystals .... See Entry 67384
Structural and compositional characterization of mixed CdS-CdSe films grown by cathodic electrodeposition .... See Entry 67397
Structure of electrolytic cobalt-nickel alloy deposits ....See Entry 67409

81.20 OTHER METHODS OF PREPARATION OF MATERIALS

68464 Carbon fibers produced by pyrolysis of natural gas in stainless steel tubes. G.G.Tibbetts (Phys. Dept., General Motors Res. Labs., Warren, MI, USA).
Appl. Phys. Lett. (USA), vol.42, no.8, p.666-8 (15 April 1983).
Carbon fibers of uniform diameter have been grown by pyrolysis of natural gas in type 304 stainless steel (18% Cr, 8% Ni) tubes at temperatures between 950 and 1075°C. The method utilizes the circulation of wet hydrogen outside the growth tube in order to promote effective nucleation. Fibers 12 cm long having average moduli 1.8×10^{11} Pa have been grown. (9 refs.)

68465 Synthesis and properties of $La_{1-x}K_xVO_3$ solid solutions with the perovskite structure. G.V.Bazuev, O.V.Makarova, G.P.Shveikin (Inst. of Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.5, p.720-4 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.859-63 (May 1982). [received: Feb. 1983]
New solid solutions with the perovskite structure $La_{1-x}K_xVO_3$, where $0\leq x\leq0.32$, were synthesized. When $x\leq0.10$, the solid solutions have a structure similar to the $LaVO_3$ structure (of the $GdFeO_3$ type, space group Pbnm, z=4, $a\approx b\approx c/\sqrt{2}$), whereas they have a rhombohedrally distorted perovskite structure (space group $R\bar{3}c$) when $x>0.10$. The electrical and magnetic properties were studied. A concentration transition from semiconductor to metallic conductivity when $x\approx0.12$ was established. (14 refs.)

68466 Preparation and electrical properties of $La_{2-x}Sr_xNiO_4$ (x=0-1.0). I.F.Kononyuk, N.G.Surmach, L.V.Makhnach (Sci.-Res. Inst. of Physicochem. Problems, V.I. Lenin Belorussian State Univ., Belorussian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.1029-31 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1222-5 (July 1982). [received: Feb. 1983]
The electrical properties of the solid solutions $La_{2-x}Sr_xNiO_4$ with x=0, 0.25, 0.50, 0.75, and 1.0 have been studied between room temperature and 700°C. It is found that as x increases from zero to 0.5, the room-temperature resistance increases from 3×10^{-4} to 8×10^{-4} Ω.m, after which it decreases to $(4\pm1)\times10^{-5}$ Ω.m at x=1.0. The conductivity of the solid solutions with $x<1$ is semiconducting between room temperature and 300-400°C and metallic at higher temperatures. The compound $LaSrNiO_4$ has n-type metallic conductivity. The temperature coefficient of the resistivity is $(15\pm2)\times10^{-4}$ deg^{-1}. (8 refs.)

81.20E Powder techniques, compaction and sintering

68467 Sintering ultra-dispersed metallic powders. V.V.Skorokiod (Inst. for Materials Sci. Problems,. Acad. of Sci., Kiev, Ukrainian SSR).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.395-9
Deals with the features of sintering ultra-dispersed metallic powders, taking into account the processes of locally-inhomogeneous densification and generation of dislocations in curing quasi-two-dimensional defects. Approximated evaluations are given for maximum possible sintering rates in accordance with the new mechanism. A qualitative correlation is demonstrated between theoretical and experimental data in the case of sintering ultra-dispersed tungsten powders. (9 refs.)

68468 Computer simulation of geometry change during liquid phase sintering. Z.S.Nikolic, M.M.Ristic (Faculty of Electronic Engng., Univ. of Nish, Beograd, Yugoslavia).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.477-81
The phenomenon of shrinkage during the liquid phase sintering is usually explained by the models developed on the base of the analogy with the experimental results. For the explanation of the shrinkage geometry the simulation method could be used. The simulation of the liquid phase sintering is used to observe the changes of the geometry model system, three spheres-plate and model system four spheres. By the choice of non-typical geometry of model-systems the authors observed the processes in the contact area and around spheres which do not form the neck area. (13 refs.)

68469 Some aspects of powder and composite materials deformation theory as a basis for improving compacting and sintering processes. S.S.Kiparisov, V.E.Perelman (Lomonosov Inst. of Fine Chem. Technol., Moscow, USSR).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.561-72
An analysis of general laws is given determining the porous articles deformation during compacting and sintering, and a description of the major factors which characterize the body deformation effect on these processes. An attempt is made to formulate the main trends of the research according to the role, place, and type of deformation effect on the sintering process. (10 refs.)

Hot-pressed barium sulphate ceramic waste forms for direct immobilisation of medium level Magnox waste .... See Entry 65417

Powder metallurgy techniques in nuclear technology .... See Entry 65472

The preparation of fine grained thermoelectric alloys by vacuum hot pressing .... See Entry 67668

Microstructure and mechanisms for recrystallization in polycrystalline PbTe samples .... See Entry 68431

Morphology of powdered products at various stages of tungsten production .... See Entry 68470

Production of high strength aluminium alloys by extrusion of atomized powders .... See Entry 68471

Liquid phase sintering of nickel base superalloys .... See Entry 68472

The effects of pressing process on sintering process and final compact properties .... See Entry 68473

Changes in dislocation and electronic structure during copper consolidation .... See Entry 68474

The effect of thermal treatment on microstructure of nickel base PM superalloys .... See Entry 68475

The effect of rhenium on the properties and structure of sintered tungsten-rhenium materials .... See Entry 68476

Mechanical and superconducting properties of Cu-Nb_3Sn in situ produced composite wires .... See Entry 68480

On formation of the structure of sintered dispersion strengthened materials .... See Entry 68481

A study on the fabrication and the lanthanum dependence characteristics of (Pb, La) (Zr, Ti) O_3 ceramics .... See Entry 68482

Preparation of a Ni-Zn ferrite from a submicronic grain size powder .... See Entry 68484

Sintering behaviour of an yttria stabilized zirconia .... See Entry 68485

The sintering behaviour of an active premullite powder obtained from kandites .... See Entry 68486

Synthesis and sintering of zirconia fine powders by hydrothermal reactions from zirconium metal and high-temperature high-pressure solutions .... See Entry 68487

Influence of powder characteristics on the sintering of lead zirconate titanate powders .... See Entry 68488

Grain and pore growth during the sintering of MgO at different water vapor partial pressures .... See Entry 68489

The investigation of sintering process and the strength of skeleton ceramics .... See Entry 68490

Sintering of partially stabilized zirconia .... See Entry 68491

Sintering of calciumphosphate ceramics for biomedical purposes .... See Entry 68492

Ultra-rapid sintering of ceramics .... See Entry 68493

The terminal layers in the 'ceramics-metal' joints after sintering .... See Entry 68495

Properties of MoMn layers sintered on corundum ceramics .... See Entry 68496

Examination of the densification processes and the structure formation in short-time sintering of cemented carbides .... See Entry 68497

Feasibility of directional solidification of lanthanum hexaboride in a boron matrix .... See Entry 68498

Stabilization of the compound $12Ca0.7Al_2O_3$ and its derivatives .... See Entry 68524

Investigation of the kinetics of the polymorphic transition and their influence on the mechanism of sintering of aluminum oxide .... See Entry 68535

Coarsening mechanism between 800° and 1400°C of thorium oxide particles dispersed in a nickel-cobalt matrix .... See Entry 68551

Non-conventional tungsten-base hard metal .... See Entry 68615

Fracture surfaces and mechanical properties of tungsten heavy metals .... See Entry 68645

The influence of structure parameters on strength and fracture toughness of brittle covalent crystals and corresponding sintered materials ..See Entry 68652

The influence of titanium carbide and bonding phase composition on the properties of titanium carbide-steel cermets .... See Entry 68653

The effects of calcining and sintering conditions on the permeability and loss of Mn-Zn-Fe ferrite .... See Entry 68669

Metallographic characterization of PM material .... See Entry 68736

81.20G Specific metals and alloys (compacts, pseudoalloys)

68470 Morphology of powdered products at various stages of tungsten production. K.S.Chernyavskii, L.A.Usova, V.A.Fal'kovskii, K.Ya.Shapiro (All-Union Sci.-Res. & Planning Inst. of Refractory Metals & Hard Alloys, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.977-83 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1158-65 (July 1982). [received: Feb. 1983]
The literature data are analysed on the morphology of the powdered products in various stages of the technology of tungsten production. In investigating the reduction process, APT $(H_2WO_4)\rightarrow WO_3\rightarrow WO_x\rightarrow W$, a number of laws of the morphological conversions are established. (18 refs.)

68471 Production of high strength aluminium alloys by extrusion of atomized powders. T.Sheppard, M.A.Zaidi, G.H.Tan (Dept. of Metall. & Materials Sci., Imperial Coll. of Sci. & Technol., London, England).
Powder Metall. (GB), vol.26, no.1, p.10-16 (1983).
The mechanism of powder consolidation in the extrusion chamber is analysed and it is shown that theoretically the specific pressures required to extrude initial powder compacts will be lower than an equivalent cast billet. The hot working range of metals is thus enlarged and inherently stiffer materials may be extruded. The extrusion of Al alloys from air atomized powders is described and the conditions required for meaningful increases in properties elaborated. The production of Al alloys reinforced by glass is also described and it is shown that although strength levels may be enhanced this type of reinforcement does not lead to a product having a combination of properties significantly more attractive than the cast and wrought product. Consideration is given to other forms of reinforcement. The extrusion of rapidly solidified Al-10Mg powder shows that this non-heat treatable alloy has properties comparable with the strongest heat treatable Al alloy. (6 refs.)

68472 Liquid phase sintering of nickel base superalloys. M.Jeandin, J.L.Koutny, Y.Bienvenu (Centre des Materiaux, Ecole Superieure des Mines de Paris, Paris, France).
Powder Metall. (GB), vol.26, no.1, p.17-22 (1983).
Sintering in the presence of a liquid phase has been applied to several nickel base superalloy powders. The optimal sintering conditions have been inferred from a systematic study of densification parameters (temperature, sintering time, particle size distribution, etc.). Under these conditions, closed porosity sintered materials whose shape conforms closely to that of the container (ceramic mould) can be obtained. The mechanical properties of the sintered preforms are rather low because of residual porosity. A subsequent densification by hot isostatic pressing or forging is therefore necessary to attain high performances. However, this complete densification stage can be carried out without a sealed container, as long as the porosity is closed. Liquid phase sintered structures do not exhibit deleterious effects from the partial melting; these are revealed only by the titanium, molybdenum, and aluminium microsegregations. (15 refs.)

68473 The effects of pressing process on sintering process and final compact properties. D.C.Stefanovic, M.M.Ristic (Electronic Faculty, Univ. of Nis, Nis, Yugoslavia).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.431-7
Investigates the change of density, microstructure and electric feature of iron powder in pressing and sintering process. Presents results of experimental

observations in large interval of the pressure change during pressing and that way the Fe electronic structure was influenced. The experimental results enable the authors to make some conclusions about changes of electronic structure during consolidation processes. Thus it may represent a basis for a more general electronic theory for materials activation during consolidation of transition metals and other metal powders. Problem of consolidation of dispersed powders, when exposed to outer forces, has been examined from the point of view of the electron theory of solids. Particular attention was paid to the questions of electron transfer in the systems analysed making use of a model formulated by Pavle Savic. (12 refs.)

68474 Changes in dislocation and electronic structure during copper consolidation. M.I.Milosevski, D.Stefanovic, M.M.Ristic (Inst. of Tech. Sci., Serbian Acad. of Sci. & Arts, Beograd, Yugoslavia).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.453-9
Presents information on the consolidation of copper powder. The relationship between dislocation density, fractional density electronic structure and compaction pressure is established. (9 refs.)

68475 The effect of thermal treatment on microstructure of nickel base PM superalloys. M.Mitkov, M.Gligic (Boris Kidric Inst. of Materials Sci., Beograd, Yugoslavia), Dj.Nikovic.
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.527-32
APK-1, APK-4 and APK-7 superalloy powders were characterized by scanning electron microscopy as well as X-ray analysis, and than submitted to the identical powder metallurgy route of compact production (hot pressing and subsequent heat treatment). Special attention was paid to the microstructure development (precipitation of γ' phase and carbides distribution), during the different stages of sample treatment. (4 refs.)

68476 The effect of rhenium on the properties and structure of sintered tungsten-rhenium materials. S.Stolarz, K.Wojtasik, M.Wojtasik (Inst. of Nonferrous Metals, Gliwice, Poland).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.551-7
The results of investigations on sintering of half-products of tungsten-rhenium alloys with rhenium contents of from 5 to 15 wt.%, produced by P/M technique are presented. In sintering conditions examined it was found that the sintering process runs more readily for alloys with lower rhenium content (up to 10 wt.%). (no refs.)

68477 Growth and thermal stability of γ/γ'-α eutectic composite. Y.G.Nakagawa (Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo, Japan), M.Nemoto.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.143-53
Summarizes the results of a series of investigations carried out for a γ/γ'-α(Ni-Al-Mo) eutectic. The subjects include a thermal analysis of the composite growth in a high temperature gradient provided by a fluidized bed cooling, a study of defect formation such as the banding structure at unstable thermal conditions, TEM observation and phase identification for microphases in an as-growth state as well as phases produced after various quench and aging treatments, and an evaluation of the composite thermal stability in terms of the microstructures and the high temperature strength. The fluidized bed placed beneath a melting furnace was proved to establish a temperature gradient equivalent to the liquid metal cooling, and to promote a stable steady growth of the composites without bandings. Quenching the eutectic above a peritectoid temperature diminished the blocky γ'. The subsequent aging treatments induced small Mo platelets above 830°C and below the temperature a metastable Ni_2Mo particle precipitation in the γ phase causing appreciable composite hardening. (6 refs.)

68478 Development of the γ-γ'-Cr_3C_2 in-situ composite. M.McLean, P.N.Quested, P.J.Henderson, K.Menzies (Div. of Materials Applications, NPL, Teddington, England).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.167-80
The effects of various alloy additions to the microstructures and properties of the γ-γ'-Cr_3C_2 in-situ composite have been investigated. Combinations of platinum and yttrium prevent the formation of an additional phase that occurs when yttrium alone is added; the phase morphology is unaffected by rhenium and ruthenium dopants. Combined quenching studies and differential thermal analysis show that phase alignment at high growth rates in this alloy is not due to plane front solidification but to highly branched carbide growth ahead of the melt/matrix interface. This mechanism allows good phase alignment to be achieved over a wide composition range. Tests on six alloy casts to commercial specifications indicate retention of, and often improvement to, the microstructures and properties obtained with laboratory control. (7 refs.)

68479 In situ composites prepared by solidification and mechanical techniques. J.D.Verhoeven (Dept. of Materials Sci. & Engng., Iowa State Univ., Ames, IA, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.267-76
An alternate in situ technique is presented for preparation of aligned microstructures which has been successfully applied to the preparation of copper alloys. In this technique, a two-phase alloy is first prepared by conventional casting techniques to produce a random array of dendrites of phase 1 in a matrix of phase 2. The casting is then reduced to wire size by mechanical reductions. It is demonstrated that the alignment of the dendritic phase produced by the mechanical reduction is surprisingly good, and that one can achieve a wide range of microstructural control over the filament size and morphology by utilization of controlled coarsening anneals followed by additional wire drawing. Examples are presented of Cu-Nb alloys which are converted to Nb_3Sn-Cu superconducting wires possessing excellent critical current values, and of Fe-Cu alloys which produce wires having quite high strength to resistivity ratios. (13 refs.)

68480 Mechanical and superconducting properties of Cu-Nb_3Sn in situ produced composite wires. A.Kolb-Telieps (Inst. fur Werkstoffkunde und Werkstofftechnik, Tech. Univ. Clausthal, Clausthal, Germany), B.L.Mordike, M.Mrowiec.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.277-81
Cu-Nb composite wires were produced from powder, electrolytically coated with tin and annealed to convert the Nb fibres to Nb_3Sn. The content was varied between 10 wt.% and 40 wt.%. The superconducting properties of the wires were determined. The mechanical properties, tensile strength, yield strength and ductility were measured as a function of volume fraction and deformation over a wide temperature range. The results are compared with those for wires produced by different techniques. (10 refs.)

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV) .... See Entry 64592

Powder metallurgy techniques in nuclear technology .... See Entry 65472

Effect of low-temperature annealing on the structure of $Cu_{57}Zr_{43}$ glass .... See Entry 66851

Gadolinium-heavy rare earth alloys: preparation, metallographic study and extraordinary Hall effect .... See Entry 67561

The preparation of fine grained thermoelectric alloys by vacuum hot pressing .... See Entry 67668

Binary metal alloys obtained by vacuum evaporation and condensation .... See Entry 68443

Sintering ultra-dispersed metallic powders .... See Entry 68467

Synthesis of alloys and phase diagram of the Cs-Te system ... See Entry 68503

Structural and compositional variations in aluminium alloys rapidly quenched from the melt .... See Entry 68527

The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys .... See Entry 68610

Fracture surfaces and mechanical properties of tungsten heavy metals .... See Entry 68645

81.20J Dispersion-,fibre-, and platelet-reinforced metal-based composites

68481 On formation of the structure of sintered dispersion strengthened materials. I.M.Fedorchenko, I.I.Ivanova, A.N.Demidik, G.F.Sarjhan (Inst. of Material Sci., Acad. of Sci., Kiev, Ukrainian SSR).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.379-85
Along with the factors determining the properties of any heat resistant materials, the properties of dispersion strengthened materials are affected by the very existence of disperse inclusions of nondeforming second phase. Investigation of mechanical properties and structural peculiarities of iron, strengthened by titanium oxide, as well as magnesium and yttrium oxides was carried out. It was shown that the influence of disperse refractory phase on the properties of materials depends on the temperature area of the test. There are four, rather definitely distinguished temperature intervals, where this influence is essentially different. The effect of strengthening depends on the nature of the destruction of matrix and ratio of matrix strength and strengthening phase. (2 refs.)

Production of high strength aluminium alloys by extrusion of atomized powders .... See Entry 68471

Coarsening mechanism between 800° and 1400°C of thorium oxide particles dispersed in a nickel-cobalt matrix .... See Entry 68551

81.20L Ceramics and refractories

68482 A study on the fabrication and the lanthanum dependence characteristics of (Pb, La) (Zr, Ti) O_3 ceramics. Chang-Yub Park, Young-Hee Lee, Ki-Hong Kwon.
Trans. Korean Inst. Electr. Eng., vol.32, no.1, p.1-6 (1983). In Korean.
Investigates fabrication of the (Pb, La) (Zr, Ti) O_3 ceramics by normal sintering method and investigates the effects on the ferroelectric characteristics and on the light transmission(%) according to La contents. The results of the investigation were as follows: the optimum soaking conditions were 1300°C, 9 hours, and it turned out that PLZT 6/65/35 has the largest electromechanical coupling factor; in addition, $k_p=0$ was found in the case of PLZT 12/65/35 and PLZT 15/65/35; the Curie temperature was decreased linearly to the La content, and the largest value of relative dielectric constant was 3836 for PLZT 9/65/35 at room temperature; the maximum value of light transmission(%) was about 23% for PLZT 9/65/35 and it was found that the fundamental absorption edge decreased linearly according to the soaking time. (10 refs.)

68483 Formation of silicon nitride fibers by nitriding silicon in a current of ammonia. T.S.Bartnitskaya, P.P.Pikuza, I.I.Timofeeva, T.Ya.Kosolapova (Inst. of Problems in Materials Sci., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.7, p.972-4 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1151-3 (July 1982). [received: Feb. 1983]
Chemical, X-ray, and crystal-optical analysis are used to investigate the process of formation of silicon nitride fibers during the nitriding of silicon with ammonia. It is shown that the yield and morphology of the fibers are determined by the reaction temperature and time and the purity of the original silicon. The fibers which are formed consist of both modifications of silicon nitride. (3 refs.)

68484 Preparation of a Ni-Zn ferrite from a submicronic grain size powder. P.A.Morell (Lab. Central de Recherches, Thomson-CSF, Orsay, France).
Rev. Tech. Thomson-CSF (France), vol.15, no.1, p.237-52 (March 1983). In French.
In order to improve the chemical homogeneity and the particle size distribution of the Ni-Zn ferrite, a study was made of the preparation of this material by the coprecipitation technology. The conditions of the synthesis are described and the material is then analyzed (chemical composition, particle size distribution, specific surface area, X-ray, microscopy, etc.) Sintering is studied on cylindrical samples, isostatically pressed at 1.6 t/cm^2. Densification is obtained either by classical sintering or by hot-pressing. In all cases porosity is less than 1%. The magnetic permeability measured at 10 KHz varies from 1800 to 3300 depending on the sintering mode involved. The microstructures are regular, the grain sizes of hot-pressed and classically sintered materials are 2 and 6 μm respectively. The sintering temperature is lower compared to that required for samples prepared from the mixed oxides technique. (8 refs.)

68485 Sintering behaviour of an yttria stabilized zirconia. L.del Olmo, P.Duran, C.Moure (Inst. de Ceramica y Vidrio, Madrid, Spain).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.401-8
Simultaneous coprecipitation of yttrium and zirconium hydroxides from water solution of chlorides was used to obtain yttria-stabilized zirconia powders. The

adequate pre-calcination of the coprecipitates produced an extremely active powder which sintered to 95% theoretical density at very low temperature ($<1300°C$). It was found that the aggregates sizes strongly influenced the final density attainable on sintered bodies. Initial-stage sintering kinetics is governed by a proportionality t^n in which n varied between 0.10 and 0.25 in the temperature range studied. As a consequence both surface diffusion and grain-boundary diffusion are probably the two mechanisms present during the initial stages of sintering. (8 refs.)

68486 The sintering behaviour of an active premullite powder obtained from kandites. J.S.Moya, F.J.Valle, S.de Aza (Inst. de Ceramica y Vidrio, Madrid, Spain).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.409-15
An active powder denominated 'premullite' has been obtained by thermal and chemical treatment from a natural halloisite on the basis of a new interpretation of the kaolinite-reaction-series. The powder has been characterized by XRD, SEM and BET. The sintering behaviour has been studied and the results favorably compared with two other powders obtained by a mixture of calcined halloisite $+Al_2O_3$ and by a gel-process. (14 refs.)

68487 Synthesis and sintering of zirconia fine powders by hydrothermal reactions from zirconium metal and high-temperature high-pressure solutions. M.Yoshimura, S.Somiya (Lab. for Hydrothermal Syntheses, Tokyo Inst. of Technol., Yokohama, Japan).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.417-22
A new method, hydrothermal oxidation method, has been developed to prepare zirconia fine powders by reactions between Zr metal and high-temperature high-pressure water or solutions. Zr metal and water sealed in a Pt capsule reacted under 98 MPa above 250°C and produced monoclinic ZrO_2 fine grains having the average crystallite size of 24 nm. Further heating of this product up to 1000°C yielded a dense sintered body of m-ZrO_2 with the maximum relative density of 99.0%. The hydrothermal oxidation method has been applied to the preparation of stabilized zirconia powders using Ca or Y solutions instead of water. A partial stabilization has been achieved when an excess Zr in the capsule was found to decompose the solutes and the solvents at higher temperatures. (9 refs.)

68488 Influence of powder characteristics on the sintering of lead zirconate titanate powders. Ramji Lal, P.Ramakrishnan (Dept. of Metall. Engng., Indian Inst. of Technol., Bombay, India).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.423-9
The initial powder characteristics of lead zirconate titanate (PZT) have a profound infuence on the sintering, structure formation and properties of the finished piezoelectric ceramics. In the present investigation lead zirconate titanate powders of different characteristics were prepared by conventional ball milling, chemical coprecipitation and spray drying. The particle size, shape, surface area and X-ray diffraction pattern of the powders have been determined. The powders were then compacted, sintered at different temperatures and sintered structure and piezoelectric properties were evaluated. These results have been reported and discussed. (11 refs.)

68489 Grain and pore growth during the sintering of MgO at different water vapor partial pressures. J.A.Varela, O.J.Whittemore (Univ. of Washington, Seattle, WA, USA).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.439-45
Presents results of a study on the effect of the partial pressure of water vapor on the rate of sintering by measuring and correlating several parameters: pore size distribution, crystal size, surface area, and bulk density. (13 refs.)

68490 The investigation of sintering process and the strength of skeleton ceramics. Yu.L.Krasulin, A.B.Ivanov, V.N.Timofeev (Baikov Inst. of Metall., Acad. of Sci., Baikov, USSR).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.447-51
Presents information relating to the field of sintering and the strength of sintered materials. Approaches are discussed about the investigation of kinetics of neck formation between particles during the process of sintering in terms of the results of strength measurements. Experimental and calculated data are presented of the investigation of this process for the example of ceramics sintered from spherical particles of stabilized zirconia. (7 refs.)

68491 Sintering of partially stabilized zirconia. B.Pavlovski, L.Ilievska (Faculty of Technol., Univ. of Skopje, Skopje, Yugoslavia).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.471-6
Using the two techniques of preparation partialy stabilized zirconia, with 6 mol.% CaO, MgO, i.e. a mixture of CaO and MgO, was obtained. The sintering of the samples was carried out at 1673, 1773 and 1873K. It can be concluded that the samples of partially stabilized zirconia, with 6 mol.% MgO, during the testing of the resistance to thermoshocks results in destabilization of the cubic ZrO_2 that also leads to rapid cracking of the samples. The zirconia-calcia solid solution, in the partially stabilized zirconia with 6 mol.% CaO, reverted partially to the monoclinic form and the samples are more resistant to thermal shocks. The best thermal shock resistance was obtained with the partially stabilized zirconia with 3 mol.% CaO and 3 mol.% MgO. The sintered samples practically do not change their phase composition during the testing of the resistance to thermoshocks. (10 refs.)

68492 Sintering of calciumphosphate ceramics for biomedical purposes. K.De Groot (Dept. of Biomaterials, Free Univ., Amsterdam, Netherlands).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.483-6
Results are summarized of studies to prepare sintered calciumphosphate ceramics from commercially available powders. These ceramics, crystallographically either apatite or β-whitlockite, have good biological properties, but are rather poor mechanically, especially with respect to fatigue behavior. Clinical applications as bone replacement material are hence limited to areas where no mechanical loading occurs, or only compression takes place. (9 refs.)

68493 Ultra-rapid sintering of ceramics. D.L.Johnson, Joung Soo Kim (Northwestern Univ., Evanston, IL, USA).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.573-8
Alpha alumina tubes have been sintered in gas plasmas generated in a 5 MHz induction coil. Very high sintering rates were observed. For instance, thin wall tubes of 0.3 μm α-Al_2O_3 with 0.25% MgO which were passed through the induction-coupled plasma at 4 cm/min densified from 50% to $>$ 98% of theoretical density in about 15 seconds. Grain growth continued with an apparent grain growth rate constant on the order of $10^{-12} cm^3/s$, which is consistent with an extrapolation of lower temperature grain growth data for dense material of similar composition. The final grain size was on the order of 4 μm. Ultra-rapid sintering has also been observed in specimens passed rapidly through a short high temperature furnace without a plasma. (14 refs.)

Hot-pressed barium sulphate ceramic waste forms for direct immobilisation of medium level Magnox waste .... See Entry 65417

Powder metallurgy techniques in nuclear technology .... See Entry 65472

X-ray luminescence spectra of A_2B_6 ceramics .... See Entry 68366

The effects of calcining and sintering conditions on the permeability and loss of Mn-Zn-Fe ferrite .... See Entry 68669

81.20N Cermets, ceramic and refractory composites

68494 Influence of sintering temperature of WMn layer on structure and strength properties of ceramic-to-metal seals. A.J.Grodzinski (Inst. of Electronic Materials Technol., Warsaw, Poland).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.533-8
Seals between corundum ceramics with 97.5% content of Al_2O_3 and an FeNiCo alloy were studied. The seals were produced by a high temperature metallizing process. The analysis produced evidence of a definite relation between technological conditions of seal production processes and the seal strength. The following chemical composition of metallic paste is as optimum for mechanical strength: 74.3% of W+15% of Mn+10.5% of lithium glass+0.2% Ni. Based on the thickness of layers left on the ceramics after the mechanical strength test, is concluded that the seals break in the metallic layer, near the boundaries of the spinal phase. (15 refs.)

68495 The terminal layers in the 'ceramics-metal' joints after sintering. W.Wlosinski (Electronic Materials Inst. of Technol., Warsaw, Poland).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.539-44
The division of intermediate layers arising from mechanical coherence, moistening and dissolution, reactive diffusion, diffusion coherence, changes of oxides in the layer-was given. The general conditions of forming the intermediate layers were given. The intermediate layers, arising between Al_2O_3 and metals, between αAl_2O_3 and βAl_2O_3, and between Al_2O_3 and Cr were handled in detail by giving the conditions of forming the layers. (11 refs.)

68496 Properties of MoMn layers sintered on corundum ceramics. W.Olesinska (Inst. Technol. Materialow Elektronicznych, Warszawa, Poland).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.545-50
Investigated processes of diffusion of components from metallic layers as well as from corundum substrates which occur during sintering of MoMn metallic layers with SiO_2 additive on leucosapphire and on material with 95% content of Al_2O_3. The influence of the SiO_2 additive on the metallic layer structure and on the basic properties of ceramic-metal seals, i.e. vacuum tightness and mechanical strength is discussed. The author has defined favourable weight proportions of Mn and SiO_2 to be used as additives for sintering of metallic layers on corundum substrates which are designed for ceramic-metal seals characterized by reproducible functional parameters. (10 refs.)

68497 Examination of the densification processes and the structure formation in short-time sintering of cemented carbides. W.Hermel, R.Krumphold, G.Leitner, S.Siegel (Zentralinst. fur Festkorperphys. und Werkstofforschung, Akad. der Wissenschaften, Dresden, Germany), K.Voigt.
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.579-84
Examination of the influence of temperature and time on the densification of WC-TiC-Co cemented carbides (7 wt.% Co) shows that by thermal activation and inductive rapid heating practically full density may be achieved after sintering times of a few minutes. The values of hardness and strength correspond to those of conventionally long-time sintered specimens. The particularities of structure formation in short-time sintering and the possibilities of their utilization are discussed. (14 refs.)

68498 Feasibility of directional solidification of lanthanum hexaboride in a boron matrix. K.V.Logan (Engng. Experiment Section, Georgia Inst. of Technol., Atlanta, GA, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.195-204
Attempts were made to directionally solidify lanthanum hexaboride as uniformly spaced rods, less than one micron in diameter, in a boron matrix. Lanthanum hexaboride and boron powders were combined in a near eutectic mixture, formed into right circular cylinders and melted by RF induction heating in a pure hydrogen atmosphere using a modified internal zone melting technique. Ball milling, uniaxial cold pressing, isostatic pressing and hot pressing were investigated as possible means of increasing the sample density before melting in the RF induction furnace. RF coupling was achieved directly in the hot pressed pellet, and indirectly through the use of a molybdenum preheater in the uniaxially cold pressed pellets. Internal zone melting and conventional crucible melting in various materials were tried. Directional growth was observed in the pellets that were uniaxially cold pressed and preheated with a molybdenum tube sleeve. Lanthanum hexaboride fibers with an l/d ratio of about ten to one and other forms of aligned microstructures were observed in selected areas of the pellet. (5 refs.)

Powder metallurgy techniques in nuclear technology .... See Entry 65472

The preparation of fine grained thermoelectric alloys by vacuum hot pressing .... See Entry 67668

Non-conventional tungsten-base hard metal .... See Entry 68615

The influence of structure parameters on strength and fracture toughness of brittle covalent crystals and corresponding sintered materials ..See Entry 68652

The influence of titanium carbide and bonding phase composition on the properties of titanium carbide-steel cermets ....See Entry 68653

81.20P Glasses

68499 Monolithicity of silane gels. M.Prassas, J.Phalippou, J.Zarzycki (Lab. de Science des Materiaux, Univ. des Sci. et Tech. du Languedoc, Montpellier, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.257-60 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The gels obtained by hydrolysis and polycondensation of tetramethoxysilane can be conserved under monolithic shape by controlling the drying step. Three methods for drying the gels are presented here. They give rise to materials, the texture and physical properties of which are very different. The structural evolution and monolithicity as a function of temperature show that only the dehydrated gels, using hypercritical evaluation of the solvent, are possible to be transformed into glasses. (4 refs.)

68500 Thermal evolution of alkali aluminosiicate gels. T.Woignier, J.Phalippou, J.Zarzycki (Lab. des Sci. des Materiaux, Univ. de Montpellier II, Montpellier, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.261-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The gels of composition K_2O-Al_2O_3-$6SiO_2$, Na_2O-Al_2O_3-$6SiO_2$, Li_2O-Al_2O_3-$6SiO_2$ were prepared following two different techniques. destabilization of a colloidal solution of silica and hydrolysis, and polycondensation of $Si(OCH_3)_4$. Al_2O_3, Na_2O, K_2O, Li_2O were added in the form of nitrates in aqueous solution. The crystallization of these gels was studied as a function of temperature by X-ray diffraction. At low temperature all these gels show characteristic X-ray peaks and also IR bands due to the presence of different nitrates. These nitrates however decompose at higher temperatures: consequently, the structure becomes amorphous. At more elevated temperature the gel containing KNO_3 shows a weaker tendency to crystallize. The contraction of the gel was found to be important at low temperatures as observed by dilatometry measurements. (9 refs.)

Effect of low-temperature annealing on the structure of $Cu_{57}Zr_{43}$ glass ....See Entry 66851

Effect of hafnium selenide (HfSe) on the crystallisation of the IR transparent chalcogenide glass $Ag_{10}Ge_{30}Se_{60}$ ....See Entry 66880

Deviations of structure between bulk and fiber glasses ....See Entry 66888

Thermodynamic relations between the crystallisation of amorphous alloys (Fe,B) and their preparation by hardening from the liquid state ....See Entry 67240

Hyperfrequency (35×10^9 Hz) study of the complex permittivity of SiO_2-xNa_2O binaries ....See Entry 68153

Synthesis of alloys and phase diagram of the Cs-Te system ...See Entry 68503

81.20Q Glass-based composites, vitroceramics

68501 Directionally crystallized potassium silicate glass-ceramic. G.Lu, L.C.Klein (Ceramics Dept., Rutgers State Univ. of New Jersey, Piscataway, NJ, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.231-40
Glasses in the potassium silicate system were directionally crystallized in a temperature gradient furnace. A composition of approximately 40 wt.% K_2O and 60 wt.% SiO_2 was used. Quenched glass samples were placed in alumina crucibles with $K_2O.2SiO_2$ seed crystals on the bottom surface. The crucible was translated from the hot zone to the cold zone of the furnace. A thermal gradient of 14°C/mm was maintained. Sample height was about 6 mm and translation rates were about 5 mm/h, 1.33 mm/h and 0.83 mm/h. Well-aligned crystals were observed to grow from the bottom of the crucible. Individual crystals were about 0.07 mm wide and extended the length of the crucible parallel to the thermal gradient. The degree of alignment was found to depend on initial temperature and translation rate. The samples have been studied using primarily optical microscopy. (11 refs.)

Effect of hafnium selenide (HfSe) on the crystallisation of the IR transparent chalcogenide glass $Ag_{10}Ge_{30}Se_{60}$ ....See Entry 66880

81.30 PHASE DIAGRAMS AND MICROSTRUCTURES DEVELOPED BY SOLIDIFICATION AND SOLID-SOLID PHASE TRANSFORMATIONS

(see also 61. Structure of liquids and solids 64.70 Phase equilibria, phase transitions, and critical points)

The system $SrMoO_4$-$BaMoO_4$-$CaMoO_4$: compatibility relations, the implications for supercalcine ceramics ....See Entry 65371

Crystallisation in oriented polymers: a framework for analysing orientation distributions ....See Entry 66898

Kinetics of a unidirectionally inhomogeneous Ising alloy ....See Entry 67160

Irradiation-driven phase transformations in alloys ....See Entry 67161

Sublimation behavior of molybdenum oxides ....See Entry 67181

Quantitative evaluation of the interfacial free energies at a solid-liquid lamellar eutectic interface ....See Entry 67315

Nuclear-gamma-resonance-spectral analysis of structural transformations of iron-containing chrysotile asbestos and its composition with polyorganosiloxane during heat treatment ....See Entry 68093

The long term structural stability of the eutectic composites Cd-Zn and Pb-Cd ....See Entry 68571

The high temperature degradation of Cd-Zn and Pb-Cd eutectic alloys ....See Entry 68572

The influence of low-temperature crystallisation on the tensile elastic modulus of natural rubber ....See Entry 68577

81.30B Phase diagrams of metals and alloys

68502 A phase diagram of the alloys of the samarium-nickel binary system. Pan Yu-ying, Zheng Jian-Xuan (Dept. of Phys., Guangxi Univ., China).
Acta Phys. Sin. (China), vol.32, no.1, p.92-5 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The samarium-nickel binary system has been studied by X-ray diffraction, differential thermal and metallographic analyses. The phase diagram has been determined. In the system the following eight intermetallic compounds were observed: Sm_3Ni (decomposes at 664°C), SmNi (M.P. 1079°C), $SmNi_2$ (decomposes at 1034°C), $SmNi_3$ (decomposes at 1135°C), Sm_2Ni_7 (decomposes at 1220°C), $SmNi_4$ (decomposes at 1282°C), $SmNi_5$ (M.P. 1430°C), and Sm_2Ni_{17} (decomposes at 1288°C). Three eutectics occur: Sm_3Ni-SmNi (570°C, ~32 at%Ni), SmNi-$SmNi_2$ (809°C, 53.5 at%Ni) and Sm_2Ni_{17}-Ni (1280°C, 94 at%Ni). Neither Sm in Ni nor Ni in Sm shows any detectable solid solubility. (13 refs.)

68503 Synthesis of alloys and phase diagram of the Cs-Te system. K.A.Chuntonov, A.N.Kuznetsov, V.M.Fedorov, S.P.Yatsenko (Inst. of Chem., Acad. of Sci., Sverdlovsk, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.937-40 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1108-12 (July 1982). [received: Feb. 1983]
The phase diagram of the Cs-Te system over the entire range of concentration was constructed. The components interact to give Cs_2Te, Cs_3Te_2, Cs_5Te_4, CsTe, Cs_2Te_3, Cs_2Te_5, and $CsTe_5$, which melt at 821, 660, 465, 408, 395, 235, and 263°C, respectively. It is shown that the tendency of the alloys of the Cs-Te system to form glasses and the large difference in the molar volumes of the components lead to the development of significant deviations from the typical schemes of distribution of the components during solidification of alloys under conditions of directed heat removal. (8 refs.)

68504 Phase diagrams of binary systems of germanium with sodium, potassium, rubidium, and cesium. M.E.Drits, V.F.Potemkin, L.L.Zusman (A.A. Baikov Inst. of Metall., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.7, p.969-71 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1148-50 (July 1982). [received: Feb. 1983]
By means of differential thermal analysis, local X-ray spectral analysis, and quantitative microstructure analysis, a study has been made of the phase diagrams of the systems Ge-Na, Ge-K, Ge-Rb, and Ge-Cs. (7 refs.)

68505 Isotopic effects in hydrogen-intermetallic compounds systems. B.Andreyev, V.Shitikov, E.Magomedbekov, A.Shafiev (Moscow D.I. Mendeleev Inst. of Chem. & Technol., Moscow, USSR).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.161-8 (April 1983).
The isotopic equilibrium of hydrogen in the H-$LaNi_5$ and H-$SmCo_5$ systems was studied at pressures of up to 2.5 MPa and a temperature of 273K. The dependence of the separation factor on the isotopic composition of hydrogen was determined. The thermodynamic parameters of tritium sorption in $LaNi_5$ and $SmCo_5$ were calculated. (21 refs.)

68506 Solid-liquid-equilibria in the α-range of copper-antimony alloys. T.Hehenkamp, R.Kossak (Inst. fur Metallphys., Univ. Gottingen, Gottingen, Germany).
Z. Metallkd. (Germany), vol.74, no.4, p.195-8 (April 1983). In German.
Employing a sensitive differential calorimeter the solidus as well as the liquidus temperatures in the α-range of solid solubility have been determined for the copper-antimony system. Strong deviations from the data published so far have been detected. (14 refs.)

68507 Thermodynamic properties of binary alloys of platinum metals. III. Iridium-rhodium. S.N.Tripathi, M.S.Chandrasekharaiah (Reactor Chem. Section, Bombay, India).
Z. Metallkd. (Germany), vol.74, no.4, p.241-5 (April 1983).
The activity of Ir as a function of composition in Ir-Rh alloys at 1443, 1461 and 1511K was determined from equilibria measurements with volatile iridium oxides. Other thermodynamic properties were than evaluated. This binary system exhibits a large negative deviation from ideal solution model and the results strongly indicate the possible miscibility gap. (11 refs.)

68508 Microstructures of the alloys in the system Pd-In-Sn. M.Abdullah, I.Kosovinc (Lehrstuhl fur Metallografie, Univ. Ljubljana, Ljubljana, Yugoslavia), K.Schubert.
Z. Metallkd. (Germany), vol.74, no.4, p.250-3 (April 1983).
The microstructures of Pd-In-Sn alloys are studied with the help of electron probe microanalysis. The phase diagram is confirmed and the morphology found is compatible with the knowledge on crystal structures. (9 refs.)

68509 The influence of alloy chemistry on controlling fiber volume fraction in Ni-base MC aligned eutectics. M.R.Jackson, J.L.Walter (General Electric Corporate Res. & Dev., Schenectady, NY, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.103-13
For the Ni-base TaC eutectics, it has been shown previously that carbide volume fraction is a strong function of Ta/C ratio. Now in a number of Ni,Cr-TaC and Ni,Cr,Al-TaC alloys, Cr has been observed to have only a small influence on volume fraction of carbide, while Al has a major influence acting to decrease the volume fraction. The Al present in the matrix causes the phase equilibrium to approach that of a much greater Ta/C ratio. This analysis has been extended to more complex NiTaC alloys as well. For the simple Ni-Cr-Ta-C alloys, creep behavior has been studied as a function of volume fraction of carbide. Other carbide systems have been evaluated as well, including TiC and NbC. A general understanding of volume fraction differences between these systems and TaC can be reached by consideration of ideal solution behavior and the appropriate phase diagrams. (10 refs.)

68510 Selective etching and laser melting studies of monotectic composite structures. L.M.Angers (Northwestern Univ., Evanston, IL, USA), R.N.Grugel, A.Hellawell, C.W.Draper.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.205-16
Thin slices of directionally solidified, fibrous composite, monotectic alloy samples have been selectively etched to remove the fibrous phase, so to produce fine sieves of filters having pore dimaters ≤10μm. Alloys in systems Al-In, Al-Bi and CuAl-Pb have been examined using as etchants aqueous nitric acid (Al-In, Al-Bi) and aqueous citric acid (CuAl-Pb) without applied anode voltages. These alloys and etchants illustrate examples in which fiber and matrix are attacked to different extents (Al-In), the phase interface is selectively attacked (Al-Bi) or only the fibers are attacked (CuAl-Pb). Hole sizes and perfection are compared for etching times, concentrations and anode voltage. Laser melting of the surface of CuAl-Pb samples has been used to screen or

frame areas of the composite microstructure and also shows how local melting of the fibrous Pb phase can be used to assess the heat affected zone. (6 refs.)

The A-15 phase of elements ....See Entry 66928

X-ray investigation of the rare earth metal-iron triad metal-boron systems ....See Entry 66931

Temperature dependence of the sound velocity and ultrasonic attenuation in liquid Bi-Ga and Bi-Sn alloys ....See Entry 67111

T-P-C state diagram of the V-Mn system in the ordering range ....See Entry 67156

Low temperature phase diagram of the A15 compounds and the tetragonal-to-tetragonal phase transition of $Nb_2Sn_{1-x}Sb_x$ ....See Entry 67196

Temperature dependence of the Hall coefficient of CuBe2 between 6 and 300K ....See Entry 67566

The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys ....See Entry 68610

81.30D Phase diagrams of other materials

68511 Phase equilibria in the system Na_2CO_3-$CaCO_3$-CO_2 at 750 to 900°C. P.Taskinen, D.Janke.
Arch. Eisenhuettenwes. (Germany), vol.54, no.2, p.53-5 (Feb. 1983).
The phase diagram of the binary system Na_2CO_3-$CaCO_3$ is presented. Determination of solid state phase equilibria by thermal analysis at 750 to 900°C and $p_{CO_2}=1$ bar, is described. (22 refs.)

68512 The *P-T* phase diagram of lithium iodate ($LiIO_3$) up to 40 kbars. Shen Zhong-yi, Liu Jun, Zhang Yun, Yin Xiu-jun, He Shou-an (Inst. of Phys., Acad. Sinica, Peking, China).
Acta Phys. Sin. (China), vol.32, no.1, p.118-23 (Jan. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The possible high pressure modifications of lithium iodate ($LiIO_3$) were surveyed in the high pressure and high temperature ranges up to 40 kbar and 750°C. Two high pressure modifications have been observed. The first is found in the range of 1.5-4.9 kbars and 310-450°C, while another appears in the pressure range above 15 kbars. The phase boundaries were determined by DTA and quenching method. The diagram published abroad in 1969 have been corrected and the stability of each phase at high pressures and high temperatures has been discussed. (16 refs.)

68513 High-temperature interaction of hafnium nitride with tungsten. S.P.Kogel', R.G.Avarbe, M.A.Eron'yan, Yu.P.Malkov.
Inorg. Mater. (USA), vol.18, no.5, p.683-6 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.812-15 (May 1982). [received: Feb. 1983]
Hafnium nitride is one of the especially refractory compounds. The dependence of the temperature of eutectic interaction of tungsten with hafnium nitride on the nitrogen pressure and oxygen content in the nitride was established experimentally. At a nitrogen pressure >1 MPa, the temperature limit of compatibility of these materials is close to the melting point of tungsten. (6 refs.)

68514 Nature of the interaction between lead and zinc chalcogenides. G.S.Oleinik, P.A.Mizetskii, A.I.Nizkova (Inst. of Semiconductors, Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.5, p.734-5 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.873-4 (May 1982). [received: Feb. 1983]
Presents the results of investigations of the phase diagrams of the PbS-ZnS, PbSe-ZnSe, and PbSe-ZnS systems; the latter is the diagonal cross section of the ternary mutual system $PbSe+ZnS \rightleftharpoons PbS+ZnSe$. The starting materials used were special purity grade; lead sulfide and selenide were produced by direct synthesis from the elements. The points of the liquidus curve of the indicated systems were determined by differential thermal analysis. (4 refs.)

68515 PbTe-Ge section of the Pb-Ge-Te ternary system. N.P.Burmistrova, R.G.Fitseva, N.R.Faizullina, V.A.Mullina (V.I. Ul'yanov-Lenin Kazan State Univ., Kazan, USSR).
Inorg. Mater. (USA), vol.18, no.5, p.737-8 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.876-7 (May 1982). [received: Feb. 1983]
Alloys of the investigated section were synthesized from the starting components in a furnace with vibrational mixing. The samples obtained were annealed at 850°C for 300 h. To determine the solubilities at room temperature, the samples, after annealing, were cooled slowly under conditions involving switching off of the furnace. To ascertain the maximal solubilities the alloys annealed at the eutectic temperature (865°C) were quenched in cold water. The alloys obtained were investigated by physicochemical analysis. The phase diagram of the PbTe-Ge system was constructed from the results of differential thermal, X-ray diffraction, and microstructural analysis and measurements of the microhardnesses. (no refs.)

68516 Investigation of the p-T-x diagram of the Sn-Se system. E.A.Aleshina, V.P.Zlomanov, A.V.Novoselova (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.765-7 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.913-16 (June 1982). [received: Feb. 1983]
The p-T-x phase diagram of the Sn-Se system was constructed in the form of p-T, T-x, and p-x projections. The equations of the lines of the two- and three-phase equilibria are presented. The parameters of the model of the associated melt that participates in the $S(SnSe_2)+L+V$ three-phase equilibrium were determined. (7 refs.)

68517 The AsSe-TlSe system. V.V.Kirilenko, V.A.Samokhov, N.G.Velikova, R.N.Shchelokov, A.V.Medvedev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.768-73 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.917-22 (June 1982). [received: Feb. 1983]
The phase diagram of the AsSe-TlSe cross section of the Tl-As-Se system was studied by DTA, XRPA and microstructural methods and by measuring the microhardness. It was shown that this cross section is pseudobinary. Two chemical compounds were detected, one, the already known $TlAsSe_2$, melting congruently at 528K, and the second, Tl_3AsSe_4, formed by a peritectic reaction at 508K. The phase diagram is characterized by the presence of two eutectics in the phase separation region in the liquid state. The glass transition temperature of the amorphous alloys was determined and calculated. It was shown that the method for calculating T_g, generally used in the chemistry of high-molecular-weight compounds, may serve for the preliminary evaluation of the nature of the chemical reaction in chalcogenide glass-forming systems. The interrelationship between the extent of the glass formation region, the structure of the glass, and the character of the phase diagram of the AsSe-TlSe system has been confirmed. (18 refs.)

68518 The $TlAsSe_2$-Se system. V.V.Kirilenko, V.A.Samokhov, N.G.Velikova, R.N.Shchelokov, A.V.Medvedev (N.S. Kurnakov Inst. of General & Inorganic Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.773-9 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.923-9 (June 1982). [received: Feb. 1983]
The $TlAsSe_2$-Se cross section of the Tl-As-Se system was studied by DTA, X-ray phase analysis and microstructural methods, and by measuring the microhardness. It was shown that this cross section is pseudobinary. The chemical compound $Tl_2As_2Se_5$ was observed, which is formed by a peritectic reaction at 220°C. The phase diagram is also characterized by the presence of an eutectic and phase separation region in the liquid phase. The glass-tansition temperature of amorphous alloys was studied. It was suggested that the method for calculating T_g, generally accepted in the chemistry of high-molecular-weight compounds, could be used in the case of these alloys, and might serve for the preliminary evaluation of the nature of the chemical reaction in chalcogenide glass-forming systems. The interrelationship between the structure of the glass and the character of the phase diagram of the $TlAsSe_2$-Se system was studied. (22 refs.)

68519 Section of the phase diagram of the In_2Te_3-Fe system in the vicinity of In_2Te_3 and thermodynamic investigation of nonionized impurity atoms in crystals with stoichiometric vacancies. E.E.Ovechkina, V.V.Kukol' (All-Union Sci.-Res. Inst. of Single Crystals, Scintillation Materials & Ultrapure Chem. Substances, USSR).
Inorg. Mater. (USA), vol.18, no.6, p.786-8 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.939-41 (June 1982). [received: Feb. 1983]
The section of the phase diagram of the In_2Te_3-Fe section of the In-Te-Fe system in the vicinity of In_2Te_3 was constructed by means of DTA, XDA, microstructural analysis, and measurements of the microhardnesses. It was established that all of the investigated impurities in In_2Te_3 are localized in the stoichiometric vacancies in the atomic state. (11 refs.)

68520 Quaternary interacting $A^{II}B^{VI}$ semiconductor systems. V.N.Tomashik, N.B.Mizetskaya, P.F.Vengel' (Semiconductor Inst., Acad. of Sci., Ukrainian SSR).
Inorg. Mater. (USA), vol.18, no.6, p.799-801 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.953-5 (June 1982). [received: Feb. 1983]
Use of thermodynamic calculations showed that one of the stable diagonal cross sections of ternary interacting systems forming a quaternary interacting system determines the position of the stable diagonal cross sections of the quaternary interacting system. The theoretical predictions for the Cd, Zn$\|$S, Se, Te system were confirmed experimentally. (10 refs.)

68521 Interaction in Ga_2S_3-Y_2O_3 and In_2S_3-Y_2O_3 systems. P.G.Rustamov, I.B.Bakhtiyarov (Inst. of Inorganic & Phys. Chem., Acad. of Sci., Azerbaidzhan SSR).
Inorg. Mater. (USA), vol.18, no.6, p.801-4 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.956-9 (June 1982). [received: Feb. 1983]
Physicochemical analytical methods were used to study the Ga_2S_3-Y_2O_3 and In_2S_3-Y_2O_3 systems. These systems are eutectic. The Y_2O_3 solubility at room temperature is 3 and 6.5 mole % in Ga_2S_3 and In_2S_3, respectively. (7 refs.)

68522 Study of the SnO_2-Ta_2O_5 system and preparation of tin tantalates and niobates. T.I.Panova, E.P.Savchenko, E.N.Isupova (I.V. Grebenshchikov Inst. of Silicate Chem., Acad. of Sci., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.852-5 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.1013-16 (June 1982). [received: Feb. 1983]
A phase diagram is constructed for the SnO_2-Ta_2O_5 system, and reveals the presence of a binary eutectic and of narrow regions of solid solutions based on SnO_2 and Ta_2O_5. The compounds $SnNb_2O_6$ and $SnTa_2O_6$, which contain tin in the divalent state, are synthesised. (6 refs.)

68523 Interaction in the Bi_2Te_3-La_3Te_4 system. P.G.Rustamov, F.M.Sadygov, Ch.I.Abilov (Inst. of Inorganic & Phys. Chem., Acad. of Sci., Azerbaidzhan SSR).
Inorg. Mater. (USA), vol.18, no.7, p.949-51 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1123-5 (July 1982). [received: Feb. 1983]
A study of the interaction in the Bi_2Te_3-La_3Te_4 system showed that the phase diagram of the Bi_2Te_3-La_3Te_4 system is of the simple eutectic type with limited solubility on the basis of Bi_2Te_3; the region of homogeneity at room temperature extends to 3 mole% La_3Te_4. The temperature dependences of the thermoelectric parameters of $(Bi_2Te_3)_{i-x}(La_3Te_4)_x$ solid solutions ($x \leq 0.03$) were investigated. (9 refs.)

68524 Stabilization of the compound $12CaO.7Al_2O_3$ and its derivatives. G.I.Zhmoidin, G.S.Smirnov.
Inorg. Mater. (USA), vol.18, no.7, p.1003-7 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1189-93 (July 1982). [received: Feb. 1983]
The matrix compound and its derivatives have been studied for a case where a mole of CaO is replaced by CaF_2 or CaS with a view to clarifying the mechanism of stabilization of the structure of the compound $12CaO.7Al_2O_3$. Quasibinary sections representing the matrix compound and its derivatives as well as the fluoride and sulfide derivatives have been constructed. The measured density of the fluoride and sulfide derivatives is less than the X-ray density for the same specimens. The measured density of the crystals of the matrix compound is 0.45% higher than the X-ray density, this being explainable by the presence of crystal-stabilizing oxygen-containing gases in the structure. Only 0.06% of gases consisting of H_2O, CO_2, O_2, and CO is sufficient for the stabilization of the $12CaO.7Al_2O_3$ structure. In the fluoride and sulfide derivatives the structure stabilization is achieved by replacing a part of the oxygen anions by fluorine and sulfur. (12 refs.)

68525 The system SrO-Nb_2O_5. P.P.Leshchenko, A.V.Shevchenko, L.N.Lykova, L.M.Kovba, E.A.Ippolitova (M.V. Lomonosov Moscow State Univ., Moscow, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.1013-16 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1202-5 (July 1982). [received: Feb. 1983]
Phase equilibria in the SrO-Nb_2O_5 system were investigated in a wide temperature range and a t vs x diagram was constructed. Six individual compounds, viz. $Sr_6Nb_2O_{11}$, $Sr_4Nb_2O_9$, $Sr_5Nb_4O_{15}$, $Sr_2Nb_2O_7$, $SrNb_2O_6$, and $Sr_2Nb_{10}O_{27}$, are formed in the system. Below 1300°C the strontium niobate $Sr_6Nb_2O_{11}$ has a homogeneity region which does not include the stoichiometric composition. The parameters of the unit cells of all the strontium niobates synthesized were determined. (13 refs.)

New phase in SnO_2-P_2O_5 system, [Mossbauer spectra] ....See Entry 67168

Investigation of some cross-sections in the system As-S-Te ....See Entry 67169

Condensation diagram for thin films of CdS_xTe_{1-x} solid solutions ....See Entry 67175

Enthalpies of mixing of ternary systems. III. The system In-Sn-Te ....See Entry 67225

Liquid phase epitaxy of $Ga_xIn_{1-x}As_yP_{1-y}$ ....See Entry 68463

Investigation of conditions of $TiBiTe_2$ formation ....See Entry 68528

Vapor pressure in the dissociation of rhenium disulfide as a function of the composition of the compound ....See Entry 68765

81.30F Solidification

(see also 64.70D Solid-liquid transitions)

68526 Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state. A.M.Glezer, B.V.Molotilov, B.Ya.Pluchek, V.V.Sosnin (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.74-80 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.701-9 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
The structure, texture, and mechanical and magnetic properties of the alloys Fe-9.6 wt.% Si-5.4 wt.% Al and Fe-6 wt.% Si, obtained in the form of thin strips by cooling from the molten state, are investigated. It is shown that defect structure formed on cooling determines the properties of these alloys to a considerable extent. (8 refs.)

68527 Structural and compositional variations in aluminium alloys rapidly quenched from the melt. J.A.Van Der Hoeven, P.Van Mourik, E.J.Mittemeijer (Lab. for Metall., Delft Univ. of Technol., Delft, Netherlands).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.158-60 (April 1983).
The relation between the local concentration of the alloying element and the microstructure has been investigated for AlSi and AlMg alloy melt spun ribbons. It has been found that there is a close relationship between solidification structure and composition and that the ribbon centre solidifies first. (3 refs.)

68528 Investigation of conditions of $TiBiTe_2$ formation. N.S.Popovich, V.K.Shura, D.V.Gitsu (Inst. of Appl. Phys., Moldavian Acad. of Sci., Kishinev, USSR).
J. Cryst. Growth (Netherlands), vol.61, no.2, p.406-8 (March 1983).
Applying X-ray diffraction, different thermal and microstructural analyses phase interactions in the Tl_2Te-Bi_2Te_3 section was investigated and the phase diagram was derived. It was shown that $TlBiTe_2$ compound is formed by peritectic reaction at 520°C and that it presents a variable composition phase having a temperature interval of crystallization of about 30°C. The given diagram explains the controversy existing in reference literature in relation to the melting temperature and some other properties of $TlBiTe_2$ and also the difficulty of obtaining crystals of this compound. (12 refs.)

68529 A study on the melting morphology of cast iron according to graphite shape. Chang Hee Lim, Hyong Yong Ra (Coll. of Engng., Seoul Nat. Univ., Seoul, Korea).
J. Korean Inst. Met., vol.20, no.12, p.1090-8 (Dec. 1982). In Korean.
The melting has been done by rapid melting method and melting morphology has been examined, according to graphite shape in cast iron. In white cast iron of Fe-C-Si system, the melt appears first along the interface between temper carbon and austenite matrix, after the minute temper carbon which was decomposed from Fe_3C diffuses to austenite to eutectic composition. In either hypo or hyper-eutectic gray cast iron, it is observed that the melt appears first at the boundary of eutectic cell. In case of the eutectic gray cast iron, the vicinity of all graphites melts at the same time. In rapidly heated and water quenched specimen of hypereutectic gray cast iron, the crystallization of fine graphites near kish graphite leads to the conclusion that kish graphite does not dissolve easily. In case of nodular cast iron, the boundary between austenite shell and austenite matrix melts first and nodular graphite dissolves very slowly. (16 refs.)

68530 Morphology of primary carbides in niobium-containing variants of M2 high speed steel. R.Riedl, S.Karagoz (Inst. fur Metallkunde und Werkstoffprufung, Montanuniv., Leoben, Austria), H.Fischmeister.
Z. Metallkd. (Germany), vol.74, no.4, p.199-205 (April 1983). In German.
Unidirectional solidification was used to study the influence of niobium on morphology and compositon of carbides formed in the as-cast state of high speed steel S 6-5-2, whose vanadium was replaced with varying amounts of niobium. The carbides are eutectic M_6C and MC and also primary MC. The latter are niobium rich and attain considerable size. Depending on the cooling conditions, the initial octahedral shape of the primary MC crystals changes to star shape or to hopper shape. The eutectic MC carbide grows along ⟨100⟩ directions, taking its orientation from the primary MC crystals. The eutectic crystallization of M_6C proceeds first in a coupled fashion, producing a lamellar morphology, but later the carbide phase overtakes the austenite and the coupling breaks down. Because of the tendency to form large MC crystals, niobium additions in ingot-processed high speed steels of this type should be limited to below ca. 1.5% and vanadium should not be entirely left out. (63 refs.)

68531 Solidification and strength characteristics of Ni-Cr-Ti and Co-Cr-Mo eutectics. M.K.Thomas (Naval Air Dev. Center, Warminster, PA, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.181-93
The results of an exploratory study of eutectics based on Ni-25Cr-15Ti (wt.%) and Co-10Cr-32Mo compositions will be presented. These alloys were selected from a total of ten different eutectic systems, all having melting points above 1200°C, a specific gravity less than 9000 kg/m^3, and a parabolic oxidation rate below 10^{-7} $g^2.cm^{-4}.s^{-1}$ at 1150°C. The Ni-25Cr-15Ti eutectic appeared to have a high volume fraction of ductile chromium fibers in a brittle Ni_3Ti matrix. Its tensile strength at 1093°C was 227 MPa^2 and its elongation was 14%. The Co-10Cr-32Mo eutectic had the highest melting point (1340°C) of the alloys screened. It appeared to solidify in a basically blade-like or lamellar structure, consisting of the intermetallic μ phase in a metallic Co (Cr) matrix. The strongest of the Co-Cr-Mo eutectics tested had a tensile strength of 164 MPa and an elongation of 15% at 1093°C. The correlation observed between the strengths of the Ni-Cr-Ti and Co-Cr-Mo alloys, compositional variations, and their microstructures will be discussed. (21 refs.)

68532 In situ electron microscopy: solidification of eutectic alloys. C.Lemaignan, J.Pelissier (Dept. de Metallurgie de Grenoble, Centre d'Etudes Nucleaires de Grenoble, Grenoble, France).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.241-51
A heating stage and an advanced video recording system were used in the 1 MeV electron microscope of CEN Grenoble. This allowed us to observe various aspects of eutectic solidification. These observations include regular lamellar solidification with faceted or nonfaceted solid-liquid interfaces, change of lamellar spacing with solidification rate, nonreciprocal heterogeneous nucleation of eutectic solidification. The authors discuss them with respect to the classical theories and introduce a new eutectic nucleation mechanism based on surface dendrites. (14 refs.)

68533 Microstructural perturbations in directionally solidified Al-In, Al-Bi and Zn-Bi monotectic alloys. B.Toloui, A.J.Macleod, D.D.Double (Dept. of Metall. & Sci. of Materials, Univ. of Oxford, Oxford, England).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.253-66
Studies have been made of the microstructures developed in directionally solidified monotectic Al-In, Al-Bi and Zn-Bi alloys, as a function of growth velocity and temperature gradient. With increasing growth velocity and decreasing gradient the microstructures show transitions from regular rod-like arrangements of the lower melting point phase, through arrays of aligned droplets to coarse irregular droplet dispersions. Intermediate stages show rods with longitudinal shape perturbations of a classic Rayleigh-type instability. The changes are discussed in terms of oscillatory instabilities at the solid-liquid interface (enhanced by increasing growth velocity and decreasing temperature gradient) coupled with ripening effects in the solid+liquid region behind the interface. (16 refs.)

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV) ....See Entry 64592

The effect of magnesium content on the structure and properties of synthetic smectites ....See Entry 66971

Solidification of the Al-In monotectic alloy in a horizontal Bridgman configuration. I. Experimental aspects and structure characterisation ....See Entry 67172

Preparation of TlP_xS_{1-x} and investigation of physicochemical properties ....See Entry 68423

Growth and thermal stability of γ/γ'-α eutectic composite ......See Entry 68477

Development of the γ-γ'-Cr_3C_2 in-situ composite ....See Entry 68478

In situ composites prepared by solidification and mechanical techniques ....See Entry 68479

Feasibility of directional solidification of lanthanum hexaboride in a boron matrix ....See Entry 68498

Synthesis of alloys and phase diagram of the Cs-Te system ... See Entry 68503

The AsSe-TlSe system ....See Entry 68517

The $TlAsSe_2$-Se system ....See Entry 68518

The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys ....See Entry 68610

The role of solidification rate on fiber distribution and mechanical properties of a directionally solidified nickel base-TaC eutectic ....See Entry 68658

Off-axis mechanical properties of a cellular Al-Al_3Ni directionally solidified eutectic ....See Entry 68659

Vapor pressure in the dissociation of rhenium disulfide as a function of the composition of the compound ....See Entry 68765

81.30H Constant-composition solid-solid phase transformations: polymorphic, massive, and order-disorder

(see also 64.70K Solid-solid transitions)

68534 Phase transformations in ferrosilicon and their influence on inhibitor-phase formation. A.A.Kononov, B.M.Mogutnov, A.V.Sumin, M.P.Usikov, L.A.Shvartsman (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.81-4 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.710-13 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
The $\alpha \rightarrow \gamma$ transformation in ferrosilicon, which has a significant influence on the solubility of inhibitor phases (MnS and AlN) in α-Fe and on the kinetics of their subsequent precipitation, is investigated. The volume fraction of austenite at the temperatures of normalization and hot rolling is determined. (5 refs.)

68535 Investigation of the kinetics of the polymorphic transition and their influence on the mechanism of sintering of aluminum oxide. I.I.Spivak, V.N.Rystsov.
Inorg. Mater. (USA), vol.18, no.7, p.984-8 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1166-71 (July 1982). [received: Feb. 1983]
The kinetic laws of the polymorphic transition of γ-Al_2O_3 obtained by roasting aluminum hydroxide are established. In the absence of external pressure no compaction is observed in the polymorphic transition of Al_2O_3, indicating that the forces arising in regrouping of the particles as a result of the $\gamma \rightarrow \alpha$ transition are greater than those due to sintering. In using γ-Al_2O_3 powders, a marked increase in final density can be obtained by realizing a high degree of cold compaction of the γ-Al_2O_3 powders ($\rho_0 > 50$-60%), which raises certain difficulties. (11 refs.)

68536 A high-temperature phase transition in $Pb_2Bi_6O_{11}$. G.A.Bordovskii, N.I.Anisimova (A.I. Gertsen Leningrad State Pedagogical Inst., Leningrad, USSR).
Inorg. Mater. (USA), vol.18, no.7, p.1016-18 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1206-8 (July 1982). [received: Feb. 1983]
Two phases (α and β) are found for $2PbO.3Bi_2O_3$ with a phase transition point at 873±5K. Both phases may coexist at room temperature and normal pressure. The α-phase is metastable below the phase transition temperature. The phase transition found may be considered a polymorphic transformation between two $Pb_2Bi_6O_{11}$ modifications. However, it is not excluded that the phase transition may also be related to the formation of a solid solution upon the decomposition of the metastable α-modification. (11 refs.)

68537 Variation of electrical resistivity in FeCo alloy on isochronal ordering. Y.Tahara (Miyakonojo Tech. Coll., Miyakonojo, Japan), K.Oki, T.Eguchi.
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.279-84 (April 1983). In Japanese.
The kinetics of isochronal ordering in FeCo alloy was investigated with the measurement of the temperature derivative of electrical resistivity α_R. The temperature derivative of electrical resistivity caused by only the order or disordering, $\Delta\alpha_R$, was estimated by eliminating other effects such as the magnetic and phonon scattering effect. The kinetic equation of ordering was applied to the case of ordering on heating with constant velocity. The variations of $\Delta\alpha_R$ of the alloy on heating at various rates, initially quenched from various temperatures, were analyzed using the expanded rate equation. In the analysis the values of 230 kJ/mol and 0.98×10^{13} s^{-1} were taken for the activation energy and the atomic frequency, respectively. (11 refs.)

68538 Thermal annealing of doubly oriented nylon 11 in contact with formic acid. M.Dosiere, J.J.Point (Univ. de l'Etat a Mons, Mons, Belgium).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.625-45 (April 1983).
The most striking feature of the mechanism of thermal annealing of doubly oriented samples of low-density polyethylene (LDPE) and probably of high-density polyethylene (HDPE) is a progressive tilt of lamellar crystals around their crystallographic *b* axis. Such a rotation does not occur on thermal annealing in doubly oriented nylons. However, this rotation mechanism occurs during the thermal annealing of doubly oriented samples of nylon 11 in contact with a solvent below its dissolution temperature. As for oriented samples of polyethylene (PE), a correlation between the changes of macroscopic dimensions and long spacing obtained from tne small-angle X-ray pattern is difficult to establish. In doubly oriented samples of nylon 11, the basal faces of the lamellar crystals are parallel to the *a* axis of the unit cell. Nevertheless, simple Miller indices cannot be assigned to the basal planes of the lamellae. On thermal annealing in formic acid, the basal planes of the lamellar crystals are, in some cases, parallel to (00*l*) planes. Annealing in formic acid at room temperature induces a phase transition: the chain *c* axis remains oriented along the rolling direction and the (00*l*) planes become parallel to the limiting planes of the lamellar crystals. (37 refs.)

Preparation of strontium tellurite single crystals .... See Entry 68425

Study of the SnO_2-Ta_2O_5 system and preparation of tin tantalates and niobates .... See Entry 68522

Stabilization of the compound $12CaO.7Al_2O_3$ and its derivatives .... See Entry 68524

The system SrO-Nb_2O_5 .... See Entry 68525

On the adiabatic shear of Ti-6Al-4V ballistic targets .... See Entry 68599

The Bainite transformation and fracture mode of Fe-C-Mn high strength steel containing high carbon .... See Entry 68629

81.30K Martensitic transformations

(see also 64.70K Solid-solid transitions)

68539 Stress-induced transformations in composite zirconia ceramics. M.Ruhle, W.M.Kriven (Inst. fur Werkstoffwissenschaften, Max-Planck-Inst. fur Metallforschung, Stuttgart, Germany).
Ber. Bunsenges. Phys. Chem. (Germany), vol.87, no.3, p.222-8 (March 1983).
The microstructure, transformation mechanisms, elastic strain distribution, and in-situ studies of the interaction of the confined zirconia particles with the stress field of the crack tip have been studied by means of high voltage transmission electron microscopy techniques. Facetted particles below a critical size d_c are retained metastably down to room temperature. The transformation is predominantly controlled by a nucleation barrier. A model of nucleation by inhomogeneity of internal strains is postulated. The 'critical size effect' may then be explained in terms of irregular-shaped particles inducing an inhomogeneous internal strain field which scales with particle size and has a well-defined d_c. (28 refs.)

68540 Volt-ampere characteristics of metastable corona electrodes [martensitic transformation]. Yu.B.Peisakhov, V.I.Tambovtsev, V.K.Usachev.
Elektron. Obrab. Mater. (USSR), no.1, p.45-7 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
A study was made of the volt-ampere characteristics of corona electrodes made from metastable and stable alloys in relation to the $\gamma\rightarrow\alpha$ martensitic transformation. There was found to be an abrupt increase in the slope of the volt-ampere characteristic curve of a static discharger in the case of the use of corona-discharge electrodes made of metastable alloys having an initial microstructure of ferromagnetic martensite. The chief reason for the increased efficiency of the static discharger is the surface micro-relief resulting from the martensitic transformation. (4 refs.) *A.J.B.*

68541 Compositional dependence of transformation temperatures in ternary TiNiAl and TiNiFe alloys. C.M.Hwang, C.M.Wayman (Dept. of Metall. & Mining Engng., Univ. of Illinois, Urbana, IL, USA).
Scr. Metall. (USA), vol.17, no.3, p.381-4 (March 1983).
Reports the compositional dependence of transformation temperatures (T_p T_d M_s etc.) in TiNiFe and TiNiAl shape memory alloys using mainly electrical resistance versus temperature measurements between temperature and liquid nitrogen temperature (−196°C). Comparing the transformation temperatures of the alloys used shows that the higher the Al or Fe content, the lower the transformation temperatures. For the purpose of studying charge density wave (CDW) transitions in these alloys, $Ti_{58.7}Ni_{37.5}Al_{3.8}$ is most appropriate, since the incommensurate phase exists over a larger temperature range. In addition, no martensitic transformation takes place in this alloy, which otherwise may interfere with the 'premartensitic' phase at lower temperatures. (15 refs.)

68542 Microstructural features of charge density wave (CDW) and martensitic transformations in TiNiFe and TiNiAl alloys. C.M.Hwang, C.M.Wayman (Dept. of Metall. & Mining Engng., Univ. of Illinois, Urbana, IL, USA).
Scr. Metall. (USA), vol.17, no.3, p.385-8 (March 1983).
Describes the product phase of the second phase transition observed in TiNiFe and TiNiAl shape memory alloys, which exhibits some features similar to those characteristic of thermoelastic martensite. (5 refs.)

68543 Effect of relaxation of transformation stresses on the martensite points. Yu.I.Paskal', A.G.Repina, Yu.N.Koval', A.A.Tukhfatullin (V.D. Kusnetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.691-4 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.14-17 (Aug. 1982). [received: April 1983]
The effect of dynamic and static relaxation of transformation stresses on martensite points is examined using a nonlocal, nonequilibrium thermodynamic description of martensite transformations. (11 refs.)

Powder neutron diffraction study of nickel-titanium martensite .... See Entry 66936

Shape memory effect in the vanadium-hydrogen system .... See Entry 68606

Wear-resistant cobalt-base alloys .... See Entry 68660

81.30M Precipitation

(inc. segregation; see also 64.75 Solubility, segregation and mixing)

68544 Analytical investigation of the precipitation of nitrides in steel. M.Kretschmer.
Arch. Eisenhuettenwes. (Germany), vol.54, no.2, p.67-71 (Feb. 1983).
Quantitative determination of the nitrides in steel by methods of analytical chemistry is described. Solution and isolation methods are discussed. Hot extraction with hydrogen is described. Experience of laboratories of the German steel industry and results of working groups are discussed. Examination of a standard sample is outlined. Considerably better evidence of the presence of different nitrides is obtained by combined use of the methods described. (19 refs.)

68545 On the structure of α'_m-precipitates in Al-Zn alloys. M.Werner, H.Loffler (Sektion Math./Phys., Padagogische Hochschule Halle, Halle, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.4, p.459-67 (1983).
The lattice parameter of the f.c.c. α'-phase in an Al-12 at.% Zn alloy decomposed at ageing temperatures ranging between 170°C and 210°C was investigated by an analysis of Moire fringe contrasts which appear inside the precipitates in TEM-micrographs. Additional information was gained concerning the relationship between the corresponding lattice of the α'_m-precipitates and the matrix. The analysis proved that the misfit between the lattice of the α'_m-precipitates and the adjoining matrix is fairly small, namely less than 1.5% in lattice spacing and less than 1° in the angular rotation. From these results it was concluded that the major part of the matrix planes passes the precipitates without interruption. (19 refs.)

68546 X-ray diffraction quantitative analysis of the Heusler alloy $CU_{2.00}Mn_{1.00}Al_{1.00}$ annealed at temperatures between 423 and 973K. R.Kozubski, J.Soltys (Inst. of Phys., Jagellonian Univ., Krakow, Poland).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.141-3 (April 1983).
Powder samples of the alloy $Cu_{2.00}Mn_{1.00}Al_{1.00}$ quenched in water after 20 h of ageing at 1123K were homogeneous, containing wholly the ferromagnetic β-phase with $L2_1$ type structure. These samples were annealed at temperatures below 973K, i.e. in the region of metastability of the β-phase which decomposes into three phases of the types: β-Mn, γ-Cu_9Al_4 and T-Cu_3Mn_2Al. The annealing time and temperature dependences of volume fraction the precipitating phases were obtained using X-ray quantitative analysis. The decomposition sequence is then examined. (5 refs.)

68547 A study of precipitation in AISI type 316 stainless steel. J.K.L.Lai (Technol. Planning & Res. Div., CEGB, Leatherhead, England).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.195-209 (April 1983).
The precipitation behaviour of nine casts of AISI type 316 steels, with aging temperatures ranging from 550 to 815°C and times up to 120000 h has been studied using a newly developed X-ray internal standard technique. At temperatures below 700°C, the data obtained are consistent with the theory that the precipitation of $M_{23}C_6$ is Cr-diffusion controlled and the precipitation of η phase in Fe-diffusion controlled. The precipitation of $M_{23}C_6$, η phase and σ phase occurs in sequence. The onset of η phase precipitation approximately coincides with the completion of $M_{23}C_6$ precipitation, while the precipitation of η phase is complete. A simple explanation based on the relative ease of nucleation of these phases and the competition for nucleation sites can explain the experimental results semiquantitatively. (22 refs.)

Conditions for the preparation and subsequent crystallization of amorphous alloys of the Ge-Te system .... See Entry 66832

SAXS and TEM studies of phase separation in BaO-SiO_2 glasses .... See Entry 66870

A transmission electron microscopical study of the σ phase in an iron-chromium steel .... See Entry 66929

Segregation of solute atoms at dislocations in low-angle grain boundaries .... See Entry 67009

Comparison between natural and synthetic grain boundaries by means of discontinuous precipitation .... See Entry 67011

Concentration and temperature dependence of the electrical resistivity of quenched PdH_x .... See Entry 67559

Temperature dependence of the Hall coefficient of CuBe2 between 6 and 300K .... See Entry 67566

The effect of thermal treatment on microstructure of nickel base PM superalloys .... See Entry 68475

Growth and thermal stability of γ/γ'-α eutectic composite ...... See Entry 68477

Preparation of a Ni-Zn ferrite from a submicronic grain size powder .... See Entry 68484

Interaction in Ga_2S_3-Y_2O_3 and In_2S_3-Y_2O_3 systems .... See Entry 68521

Morphology of primary carbides in niobium-containing variants of M2 high speed steel .... See Entry 68530

On the influence of impurity additions and quenching temperature on the course of the microhardness (HV) during a two-step ageing treatment of an Al-2.0 at.% Zn-1.3 at.% Mg alloy .... See Entry 68567

Intergranular fracture of high purity iron due to oxygen .... See Entry 68626

Precipitation induced embrittlement after thermal exposure of high-manganese, austenitic retaining-ring steels .... See Entry 68648

Relevance of microstructure to stress corrosion cracking in Al-5% Zn and Al-5% Cu alloys containing titanium .... See Entry 68696

81.40 TREATMENT OF MATERIALS AND ITS EFFECTS ON MICROSTRUCTURES AND PROPERTIES

68548 X-ray study of fine structure of Si-$ZrSi_2$ eutectic obtained by oriented crystallization. L.K.Savitskaya, L.S.Derevyagina, L.M.Butkevich, T.N.Safonova (V.D. Kuznetsov Siberian Physicotech. Inst., USSR).
Inorg. Mater. (USA), vol.18, no.7, p.965-8 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1143-7 (July 1982). [received: Feb. 1983]
In the direction parallel to the axis of growth of the eutectic of the Si-$ZrSi_2$ system, the lattice of the silicon matrix is compressed, and the lattice of the $ZrSi_2$ fibers is stretched. In the transverse direction, there are no distortions

of the lattice. By selective etching of the matrix or the fibers, it has been shown that these deformations are elastic. The coherent scattering regions in the silicon matrix are not equiaxial. They are elongated in the direction perpendicular to the growth axis. As the crystallization velocity is increased, the shape of these regions approaches equiaxial. Microdistortions of the second kind in the silicon matrix are anisotropic. In the direction perpendicular to the growth axis, they are considerably larger than in the longitudinal direction. (10 refs.)

68549 Thermal effect of nitrogen implantation on high carbon steels. E.Ramous, G.Principi, L.Giordano (Istituto di Chimica Industriale, Univ. di Padova, Padua, Italy), S.Lo Russo, C.Tosello.
Thin Solid Films (Switzerland), vol.102, no.2, p.97-106 (15 April 1983).
Quenched and annealed samples of a high carbon steel implanted with 105 keV nitrogen at a nominal dose of 3×10^{17} ions cm^{-2} and current densities of 50, 100 and 200 μA cm^{-2} were analysed by a nuclear technique to measure the retained dose. The dose thus measured depends on the beam current density as well as on the initial steel structure: it decreases with the beam current density and is systematically lower in quenched steel than that in the annealed steel. Microhardness measurements and conversion electron Mossbauer scattering were used to study the structural modifications induced by various implantation conditions. The mean implantation temperature of the samples, as evaluated on the basis of the microhardness values and checked by a thermocouple, lies in the tempering range of hardened structures at the above implantation current densities. The metallurgical transformations observed can account for the different amount of retained implanted ions in the first 200 nm below the surface. (17 refs.)

Bremsstrahlung beams from high-power electron accelerators for use in radiation processing ....See Entry 65802

Influence of sintering temperature of WMn layer on structure and strength properties of ceramic-to-metal seals ....See Entry 68494

81.40C Solid solution hardening, precipitation hardening, dispersion hardening

68550 Heat emission during the quenching of a metal in an electrical field. A.A.Skimbov, I.A.Kozhukhar', Yu.A.Shcheglov, A.S.Lymar'.
Elektron. Obrab. Mater. (USSR), no.1, p.42-5 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
The process of quenching a metal in oil in an electrical field is examined. It is found that parts quenched by this new method are harder by 15-16% than similar parts oil-quenched in the absence of an electrical field. It is shown that electro-convection intensifies the process of heat exchange and causes a three-to fourfold increase of the heat transfer coefficient. (6 refs.) *A.J.B.*

68551 Coarsening mechanism between 800° and 1400°C of thorium oxide particles dispersed in a nickel-cobalt matrix. M.Ghodsi, T.Beatse (Univ. Libre de Bruxelles, Bruxelles, Belgium).
Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.387-92
The coarsening of fine thorium oxide particles dispersed in a nickel-cobalt matrix has been studied in a temperature range of 800 to 1400°C and a N_2-4% H_2 atmosphere. In a first stage, densification of the metal phase leads to the formation of oxide clusters which by contact and surface diffusion sinter together. This phenomenon continues at least until a 24 hour treatment at 1000°C and is characterised by the presence of polycrystalline grains which undergo rearrangement and spheroidisation. From 1100°C onward, the Ostwald ripening mechanism, as described by the kinetic law of C. Wagner (1961), is predominant. For these temperatures, the Arrhenius type equation gives an activation energy of growth compatible with a mechanism by diffusion of oxide ions along metal grain boundaries. (8 refs.)

On formation of the structure of sintered dispersion strengthened materials ....See Entry 68481

Effect of ion implantation on creep of molybdenum ....See Entry 68595

Strain localization during fatigue of precipitation-hardened aluminium alloys ....See Entry 68646

Wear-resistant cobalt-base alloys ....See Entry 68660

Formulas of estimation of the critical quenching temperature for the carburization occurring in steels during vacuum oil-quenching ....See Entry 68691

Carbide-dispersion carburizing of vanadium steels ....See Entry 68692

81.40E Cold working, work hardening; annealing, recovery and recrystallisation; textures

68552 Texture transformations in the recrystallization of the alloy Fe-3% Si. I.V.Gervas'eva, B.K.Sokolov, I.P.Pechkurova, A.G.Zhigalin (Inst. of Metal Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.43-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.669-74 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
Using the distribution function of the orientation, the deformational and recrystallization texture is analyzed by means of the Roe method after single and double rolling of the engineering steel Fe-3% Si. It is shown that the distribution of the orientational density is continuous in character, and the description of such texture by ideal components is incorrect. (13 refs.)

68553 Influence of the matrix structural state on the development and perfection of ribbed texture in secondary recrystallization in the alloy Fe-3% Si. V.Ya.Gol'dshtein, R.L.Gershman, T.A.Komissarova, A.A.Savinskaya (Chelyabinsk Sci. Res. Inst. of Metall., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.49-52 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.675-8 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
An investigation was made of the kinetics of the development of secondary recrystallization and of the features of the initial-matrix structure after decarbonizing annealing of samples of a series of melts showing different levels of magnetic properties after high-temperature annealing (HTA). Comparison of the experimental data on the growth rates of matrix grains initiated by secondary recrystallization and of the features of the initial-matrix structure after decarbonizing annealing of samples of a series of melts showing different levels of magnetic properties after high-temperature annealing (HTA). Comparison of the experimental data on the growth rates of matrix grains initiated by secondary recrystallization and the kinetics of this process with data on the perfection of the developing rib structure leads to the conclusions that the quality of primary recrystallization and when secondary recrystallization occurs intensively. With weak stabilization of the matrix, secondary recrystallization develops slowly and, as well as the grains of rib orientation, there arises the possibility of the growth of crystallites of different orientations. The latter is experimentally confirmed by the results of investigating the textural changes at the state of secondary recrystallization. (5 refs.)

68554 Basic conditions for the formation of perfect ribbed texture on secondary recrystallization in ferrosilicon. V.M.Segal, V.A.Gustomesov, M.B.Tsyrlin, A.M.Tseitlin (Ural Sci. Res. Inst. of Ferrous Metals, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.53-6 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.679-83 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
Four different combinations of cold rolling, recrystallization annealing, decarbonising annealing, high temperature annealing and other forms of heat treatment are used to obtain electrical engineering steel with a perfect ribbed texture. The results are discussed in terms of the structural prerequisites for secondary recrystallization. (9 refs.)

68555 Influence of elastic stress on the formation of cubic and axial $\{hk0\}\langle 001\rangle$ texture in 3% ferrosilicon. R.I.Malinina, N.N.Konev, M.V.Anisimova (Moscow Inst. of Steels & Alloys, Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.57-61 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.684-8 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
The change in Gibbs energy of crystallites of different orientations in the field of residual elastic stress is estimated at room temperature and at 500°C in sheets of 3% ferrosilicon. It is shown that, in the elastic-stress field, the increase in Gibbs energy depends on the crystallite orientation. (11 refs.)

68556 Kinetics of grain growth. V.Yu.Novikov (Moscow Inst. of Steels & Alloys, Moscow, USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.62-5 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.689-92 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
The results of mathematical modeling of the process of grain growth in a nontextured material and a material with scattered texture are given. The kinetics of grain growth in the presence of a retarding or 'additional' (besides the decrease in total energy of the grain boundaries) motive force and also of growth in a sheet sample is described by equations differing from $\bar{D}^2$-$\bar{D}D_0{}^2=At$ (1) or $\bar{D}=kt^0$u.^{5} in the magnitude of the power index or in form. (14 refs.)

68557 Influence of small deformations on the stability of fine-grain structure in the alloy Fe-3% Si. B.K.Sokolov (Inst. of Metal Phys., Acad. of Sci., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.66-8 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.693-5 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
It is shown, for the engineering alloy Fe-3% Si, that small (subcritical) tensile deformations (about 1%) lead to hindering of the collective grain growth in conditions of slow heating with annealing. (15 refs.)

68558 Structure of very thin strips of electrical-engineering steel. V.P.Baryatinskii, V.V.Sosnin, M.Yu.Polyakov, V.V.Shitov, G.D.Belyaeva, A.V.Chebyshev, A.I.Medvedeva (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.71-3 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.698-700 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
The influence of a high content of inclusions (mainly of nitride type) in the unrolled sample on the formation of fine structure in a very thin tape of electrical-engineering steel is investigated. It is shwon that the bulk density of particles in the finished tape is larger by a factor of 1.5-2 than in the unrolled sample, as a result of the presence of a finely disperse component of size less than 500 Å. (5 refs.)

68559 A theory of non-linear anisotropic hardening. D.W.A.Rees (Engng. School, Trinity Coll., Dublin, Ireland).
Proc. Inst. Mech. Eng. Part C (GB), vol.197, p.31-41 (March 1983).
A yield function is derived which accounts for translation, contraction and rotation of the yield surface in the progress of plastic deformation for non-linear work-hardening materials. The present theory removes the restrictive condition of a rigid translation implicit in linear work-hardening by the kinematic hardening rule. The function proposed is shown to be in good agreement with experimentally determined yield loci for 2.25%Cr-1%Mo alloy steel at room temperature in a principal biaxial stress subspace and those for aluminium 1100 at room and elevated temperatures in a combined tension-torsion stress subspace. Parameters pertaining to translation are determined, in confirmation of the theory, from reversed yielding torsion tests on tubes of En 3B steel. (17 refs.)

68560 An X-ray diffraction study of lattice imperfection in cold-worked FCC alloys. IV. Copper-germanium (alpha-phase). S.K.Ghosh, M.De, S.P.Sen Gupta (Dept. of General Phys. & Indian Assoc. for the Cultivation of Sci., Calcutta, India).
J. Appl. Phys. (USA), vol.54, no.4, p.2073-8 (April 1983).
For pt.III see S.K. Halder and S.P. Sen Gupta, ibid., vol.48, p.5310 (1977). X-ray Fourier line profile analysis has been performed on four compositions of copper-germanium (FCC) alloys containing 3.05, 6.00, 9.25, and 10.00 at.% of solute germanium. The diffraction profiles from 111, 200, 220, 311, 222, and 400 reflections for both cold-worked and annealed samples in each case have been recorded in a counter diffractometer with Cu radiation using a LiF crystal monochromator. Detailed studies on recorded profiles, considering recent developments in the analyses (as in Papers I-III), for peak shift, peak asymmetry, and peak shapes have been made in order to evaluate the microstructural parameters characterizing the deformed states of the materials. Both the effects of lattice parameter change ($\Delta a/a_0$) and long-range residual stress σ are found to be negligible in causing the net peak shifts. Quantitative estimations of intrinsic (α'), extrinsic (α''), and twin (β) stacking fault probabilities have been made, and results have clearly shown the increased presence of intrinsic faults over the extrinsic ones and a complete absence of deformation twin faults in accordance with the previous observations (Papers I-III). The values of dislocation density ρ have been evaluated from anisotropic domain sizes and RMS microstrains. Considering the two expressions

for the stacking fault energy (Williamson and Smallman, 1956; Schramm and Reed, 1975), the stacking fault energy of pure Cu (γ_0) have also been estimated. (20 refs.)

68561 Development of residual stress in roll straightened tubes. Dong Nyung Lee (Coll. of Engng., Seoul Nat. Univ., Seoul, Korea), Young Hoon Chung, Myung-Chul Shin.
J. Korean Inst. Met., vol.20, no.12, p.1086-9 (Dec. 1982). In Korean.
In order to study development of residual stresses in tubes due to roll straightening, a transverse compression test has been made. Development of tensile residual stress in the outer layer and compressive stress in the inner layer of tube, and expansion of the tube diameter have been found to be inherent problems in the roll straightening. (3 refs.)

68562 The work-hardening behaviour of hydrogen-charged high purity iron single crystals at temperatures between 296 and 200K. A.Kimura, H.Matsui, H.Kimura (Tohoku Univ., Sendai, Japan).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.211-22 (April 1983).
Three-stage work hardening is observed when high purity iron single crystals of single-slip orientation are tested in tension during hydrogen charging between 296 and 200K. The effects of hydrogen on the deformation behaviour, i.e. The temperature and orientation dependence of the stress-strain curve the slip lines, the dislocation structures and the rotation of the specimen axis during deformation, were investigated. Hydrogen causes marked softening, and stage I′ proceeds with single slip by the motion of primary screw dislocations. After overshooting, stage II′ sets in with the long-range motion of secondary screw dislocations. The length of state I′ increases with the distance of the initial specimen orientation from the double-slip boundary and with decreasing temperature down to 225K. The results are discussed in terms of the variation in the difference between the mobilities of edge and screw dislocations due to the hydrogen. Hydrogen charging increases the uniform elongation of the crystal because it results in a long stage I′. The fracture is of a semibrittle nature in contrast with the complete ductility in specimens without hydrogen. (16 refs.)

68563 Work hardening and dynamical recovery in silicon and germanium at high temperatures and comparison with FCC metals. H.Siethoff (Phys. Inst., Univ. Wurzburg, Wurzburg, Germany), W.Schroter.
Scr. Metall. (USA), vol.17, no.3, p.393-8 (March 1983).
The work-hardening coefficient θ in the deformation stages III, IV, and V of the stress-strain curves of silicon and germanium was analysed. In stage III, θ decreases linearly with the shear stress; the linear extrapolation $\theta \rightarrow 0$ defines a maximum stress τ_{IIIm}, which shows the same temperature and strain-rate dependence as τ_{III}, the stress at the beginning of stage III. This indicates the same recovery mechanism (climb) to operate in the entire stage III. In stage V, the decrease of θ with stress is not linear. $\theta(\tau)$-curves, published in the literature for gold and aluminum, are rather similar to those found for silicon and germanium at comparable temperatures, thus indicating the hardening curves of these FCC metals also to consist of five deformation stages. In stage III of gold, a diffusion-controlled recovery mechanism seems to be rate controlling at high temperatures. (17 refs.)

68564 Effect of electric current pulses on the recrystallization of copper. H.Conrad, N.Karam, S.Mannan (Dept. of Materials Engng., North Carolina State Univ., Raleigh, NC, USA).
Scr. Metall. (USA), vol.17, no.3, p.411-16 (March 1983).
Presents the results obtained for the concurrent application of d.c. pulses during the isochronal annealing of cold-worked copper. The observed effects of the current pulses include: (a) a reduction in the temperature for the onset of recrystallization, (b) a reduction of the volume fraction of annealing twins and (c) an enhancement of the rate of grain growth. It is proposed that the higher mobility of dislocations produced by the electric current is in part responsible for these effects, either directly or indirectly. However, other electron-defect interactions and local (spike) heating effects may also be important. (25 refs.)

68565 The questionability of empirical work-hardening laws. L.Ratke, P.I.Welch (Inst. fur Metallkunde & Metallphys., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Z. Metallkd. (Germany), vol.74, no.4, p.226-32 (April 1983).
The differential *n*-value—i.e. the instantaneous slope of the logarithmic true stress true strain curve—was experimentally determined for five materials as a function of strain. A typical variation of the *n*-value was found for all five materials: an increase at small strains, a maximum, and a continuous decrease at higher strains up to maximum load. A comparison of the measurements with the predictions obtained from four classical work hardening theories (Hollomon, Ludwik, Swift/Krupskowski, Voce) showed that all these empirical descriptions of the stress-strain curve using constant parameters are unable to describe the work hardening behaviour of polycrystalline materials. The divergence of the measured results from those predicted are so large that these 'laws' are highly questionable and their use should be discontinued. It is technologically and physically necessary to measure the differential *n*-value (as it is described here) experimentally without the assumption of any particular strain hardening law. (56 refs.)

Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys ....See Entry 64574

Effect of low-temperature annealing on the structure of $Cu_{57}Zr_{43}$ glass ....See Entry 66851

Effective elastic properties of axial textures ....See Entry 67088

Diffusion induced grain boundary migration and recrystallization in the Cu-Ni system ....See Entry 67292

Influence of repeated heat treatment on critical current density of Nb-50 wt.%Ti alloy superconductors ....See Entry 67871

Muonic method of investigating the magnetic properties of electrical-engineering steels ....See Entry 67951

Influence of additives in the composition of thermostable coatings of the structure and properties of the alloy Fe-3% Si ....See Entry 67955

Electromagnetic losses of thin magnetically soft ferromagnets at prevailed magnetic-reversal frequencies ....See Entry 67959

Investigating the regular behavior of the magnetic losses of cold-rolled isotropic electrical-engineering steel with the aim of creating standard samples ....See Entry 67965

An EXAFS investigation on the effect of cold rolling on copper ....See Entry 68360

Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state ....See Entry 68526

Study of internal friction at high temperatures of high purity polycrystals and single crystals of nickel ....See Entry 68582

Deformation in 30% cold-rolled Cu-30Zn brass grains ....See Entry 68598

Hydrogen embrittlement of yttrium ....See Entry 68625

The influences of heat-treatment and cold-work on the low temperature hydrogen embrittlement of austenitic stainless steels ....See Entry 68628

Effects of cold rolling and annealing on the mechanical properties of 90W-7Ni-3Fe heavy alloys ....See Entry 68654

Carburizing of dual-phase steel ....See Entry 68693

Relevance of microstructure to stress corrosion cracking in Al-5% Zn and Al-5% Cu alloys containing titanium ....See Entry 68696

81.40G Other heat and thermomechanical treatments

68566 Fine-grain creation in high-silicon electrical-engineering steel. A.M.Glezer, B.V.Molotilov, V.Z.Pogosov (I.P. Bardin Central Sci. Res. Inst. of Ferrous Metall., USSR).
Bull. Acad. Sci. USSR, Phys. Ser. (USA), vol.46, no.4, p.69-70 (1982). Translation of: *Izv. Akad. Nauk SSSR Ser. Fiz.*, vol.46, no.4, p.696-7 (1982). [received: May 1983] (Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys, Asha, USSR, 15-17 Sept. 1981).
It is shown that increase in rate of crystallization, after vacuum smelting, modification with cerium, the elimination of forging and hot rolling as undesirable technological operations, and finally warm rolling under optimal conditions, allows the plasticity of high-silicon (6 wt.%) electrical-engineering steel to be increased in cold rolling. This result is based on the engineering steel to be increased in cold rolling. This result is based on the reduction in initial and effective grain size to 50 and 3-4 μm, respectively. (2 refs.)

68567 On the influence of impurity additions and quenching temperature on the course of the microhardness (HV) during a two-step ageing treatment of an Al-2.0 at.% Zn-1.3 at.% Mg alloy. R.Gerlach, H.Loffler (Sektion Math. Phys., Padagogische Hochschule Halle, Halle, Germany).
Cryst. Res. & Technol. (Germany), vol.18, no.3, p.367-74 (1983).
A pure as well as the analogous technical alloy were directly quenched from T_q=400°C or 490°C to T_a, preaged at T_a (ranging between 50°C and 160°C) various times (t_a), and subsequently postaged at RT up to t_{post}=42 d. Ageing the samples below the upper limit temperature of the homogeneous formation of GP zones (T_{hn}) no essential difference in the course of the HV-number attained after one- as well as two-step ageing in dependence on the addition of impurity atoms and T_q could be found. Contrary to this behaviour after pre-ageing at $T_a > T_{hn}$ and postageing at RT a variation of both T_q and the content of impurity atoms shows a considerable effect. The reason is the difference in the density of nucleation sites for heterogeneous formation of precipitates of the η'-and/or η-phase in dependence of T_q and impurity content. (12 refs.)

68568 Properties of polycrystalline indium oxide in the air and in vacuum. A.E.Solov'eva, V.A.Zhdanov, V.L.Markov, R.R.Shvangiradze.
Inorg. Mater. (USA), vol.18, no.5, p.693-6 (May 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.5, p.825-8 (May 1982). [received: Feb. 1983]
The properties of polycrystalline indium oxide were studied relative to the annealing temperature in air and in vacuum. Indium oxide begins to change its chemical composition upon annealing in the air at 1200°C and at 800°C in vacuum. Upon annealing of the samples in air from 1200° to 1450°C, the indium lattice apparently loses only oxygen. This process is accompanied by a change in the sample color, electrophysical properties, unit cell parameter, and density. The cationic sublattice begins to break down in vacuum starting at 900°C. This process is accompanied by destruction of the color centers. The X-ray phase analysis data and deviation from stoichiometry of indium oxide relative to the annealing temperature in air were used to calculate the radiographic density and activation energy for reduction taking account of formation of the color centers. (7 refs.)

68569 Hot rolling of Sendust. S.Watanabe, T.Sato, S.Hanada (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.329-35 (April 1983). In Japanese.
Deformability by hot rolling of Sendust with the nominal composition of 9.6% silicon, 5.4% aluminum and balance iron has been investigated as a function of hot rolling temperature and reduction per pass. It was found that under the optimum rolling conditions. Sendust became ductile and was hot rolled without grain boundary cracking or cleavage cracking. The optimum rolling conditions are consistently derived from conditions of ductile deformation in tensile or bending tests at the lower strain rate region. (13 refs.)

68570 Effect of composition on deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust. S.Watanabe (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan), Z.Nakamura, S.Hanada, T.Sato, O.Izumi.
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.351-8 (April 1983). In Japanese.
Deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust have been investigated as a function of composition. With increasing silicon content at a constant aluminum content, deformability decreases, while it is not changed by increasing aluminum content at a constant silicon content. These results are qualitatively explained on the basis of mechanical tests at lower strain rates. Magnetic properties are improved by hot rolling, and especially the initial permeability is raised in the low frequency range. Molding and μ_i-temperature characteristics of cast and hot rolled Sendust are quite sensitive to composition. Segregation of alloying elements introduced during solidification is removed by hot rolling. (8 refs.)

68571 The long term structural stability of the eutectic composites Cd-Zn and Pb-Cd. G.D.Delamore, R.W.Van De Merwe, D.P.Dunne, R.W.Smith (Dept. of Metall. Engng., Queen's Univ., Kingston, Canada).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.283-90
It is shown that marked microstructural coarsening can occur when eutectic composites are exposed for relatively short periods to temperatures approaching 0.9 T_m (where T_m is the eutectic melting temperature in K). Less well known and, perhaps, of more practical importance, are the microstructural changes and consequent changes in properties which result from prolonged exposure at 'safe' operating temperatures, e.g. 0.5 T_m. Cd-Zn and Pb-Cd eutectic specimens of various thermal histories were examined immediately on preparation and subsequently re-examined after storage at ambient laboratory temperatures for up to 1000 days. In general, microstructural changes from the as-grown and heat-treated conditions were observed. In some cases for the Pb-Cd alloy this consisted of only slight thickening of the already coarse lamellae terminations. However, in the more rapidly frozen, and therefore microstructurally finer, specimens marked discontinuous coarsening was observed, but confined to eutectic-cell-wall regions. There the coarse precipitates grew at many angles, including being perpendicular to the eutectic habit plane, but were not separated by any well-defined large angle grain boundaries. It was concluded that high temperature degradation occurs mainly by

continuous coarsening, whereas at low temperatures microstructural changes are effected mainly by discontinuous coarsening. (7 refs.)

68572 The high temperature degradation of Cd-Zn and Pb-Cd eutectic alloys. R.H.van de Merwe, R.W.Smith (Queen's Univ., Kingston, Canada).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.291-304
Various thermal treatments have been applied to Cd-Zn and Pb-Cd eutectic alloys in an attempt to better understand the thermal stability of eutectics close to their melting temperatures. Specimens of each system were grown at 40, 400 and 4000 mm/hr to obtain microstructures which were either lamellar, lamellar/cellular, or cellular. These specimens were thermally treated by either: (1) isothermal annealing at 0.95 Tm (up to 192 hrs), (2) thermal cycling between room temperature and 0.95 Tm (up to 64 cycles), (3) exposing to thermal gradients parallel to the growth direction and maintaining one end of the specimen at 0.95 Tm and the opposite end at room temperature (up to 48 hrs). It was found in all cases that some microstructural changes occurred but that the two alloy systems displayed marked differences in degradation sequence. An explanation and interpretation of these decay sequences is attempted. The mechanical properties of the variously treated alloy specimens were determined and are correlated with the observed microstructural features. The Cd-Zn specimens coarsened more rapidly than equivalent Pb-Cd specimens, as might be expected since the interphase boundary energies have been reported as 86 and 67 erg/cm^2 respectively. (31 refs.)

68573 The response of MnSb-Sb composites to isothermal aging. T.F.Marinis (Bell Telephone Labs., Allentown, PA, USA), R.F.Sekerka.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.315-27
A eutectic alloy of antimony and manganese was directionally solidified to produce a composite of cylindrical fibers of MnSb aligned in a Sb matrix. The fibers were about 3 microns in diameter by 1 millimeter long and occupied 30% of the composite volume. Isothermal aging caused the fibers to develop undulations that had an average wavelength of 1.74±0.45 times the fiber circumference. The Nichols' and Mullins' model of fiber spheroidization predicts an undulation wavelength of $\sqrt{2}$ times the fiber circumference, for interface diffusion control. The Coine model, for volume diffusion control, predicts a wavelength that approaches infinity for this fiber volume fraction. The authors' modeling efforts have shown that the predicted wavelength is quite sensitive to the assumed spatial correlation between nodes on adjacent fibers. They also found that the undulation growth rate achieves a broad maximum as a function of wavelength, which may account for the large standard deviation associated with our measurements. (5 refs.)

Effect of isothermal annealing on the structure of an amorphous Pd-Si alloy .... See Entry 66866

SAXS and TEM studies of phase separation in BaO-SiO$_2$ glasses .... See Entry 66870

Study of structural relaxation induced by irradiation of Se glass by measuring the micromechanical properties .... See Entry 66891

Vacancy defects in GaAs:Sn .... See Entry 66985

Thermal expansion of rolled and extruded uranium .... See Entry 67247

Electrical properties of rapidly quenched lithium-silicate glasses .... See Entry 67279

Physical properties of Ni contacts to CdTe .... See Entry 67293

Effects of ion implantation on the thermal growth of Pt and NiPt silicides .... See Entry 67400

Electrical conductivity and morphology of silicon in A-S13 and A-S7G .... See Entry 67557

A study of impurities and traps in liquid phase epitaxial InP in relation to melt prebaking .... See Entry 67813

Influence of repeated heat treatment on critical current density of Nb-50 wt.%Ti alloy superconductors .... See Entry 67871

Influence of cooling rate on the magnetic properties of untextured electrical-engineering steels .... See Entry 67962

Magnetic properties of Ni, Fe and Co thin films with sulfur impurities .... See Entry 67982

Nuclear-gamma-resonance-spectral analysis of structural transformations of iron-containing chrysotile asbestos and its composition with polyorganosiloxane during heat treatment .... See Entry 68093

The dielectric breakdown properties, current density-voltage and capacitance-voltage characteristics of ion-beam-synthesized Si$_3$N$_4$ layers ... See Entry 68129

The role of the pretreatment of the source material in chemical transport processes; effect of oxygen on growth of ZnS .... See Entry 68416

Microstructure and mechanisms for recrystallization in polycrystalline PbTe samples .... See Entry 68431

Highly oriented zinc oxide films .... See Entry 68437

The effect of thermal treatment on microstructure of nickel base PM superalloys .... See Entry 68475

Growth and thermal stability of γ/γ'-α eutectic composite ...... See Entry 68477

Development of the γ-γ'-Cr$_3$C$_2$ in-situ composite .... See Entry 68478

PbTe-Ge section of the Pb-Ge-Te ternary system .... See Entry 68515

Structural and compositional variations in aluminium alloys rapidly quenched from the melt .... See Entry 68527

Phase transformations in ferrosilicon and their influence on inhibitor-phase formation .... See Entry 68534

Thermal annealing of doubly oriented nylon 11 in contact with formic acid .... See Entry 68538

A study of precipitation in AISI type 316 stainless steel .... See Entry 68547

Basic conditions for the formation of perfect ribbed texture on secondary recrystallization in ferrosilicon .... See Entry 68554

Influence of small deformations on the stability of fine-grain structure in the alloy Fe-3% Si .... See Entry 68557

Stabilization of copper alloys by heat treatment .... See Entry 68587

Assessment of the susceptibility to hydrogen embrittlement with an original specimen. I. Effect of heat treatment on delayed failure time of 38 NiCrMo 4 steel .... See Entry 68617

Brittleness of Sendust .... See Entry 68627

The influences of heat-treatment and cold-work on the low temperature hydrogen embrittlement of austenitic stainless steels .... See Entry 68628

About embrittlement process in amorphous metals .... See Entry 68630

Strength of optical fibres under combined stresses and aging in various environments .... See Entry 68634

Analytical description of ageing of polyamide 6 subjected to fatigue failure .... See Entry 68642

Influence of the breakdown mechanism on the behavior of lead-antimony alloys with an alternating load .... See Entry 68651

The influence of titanium carbide and bonding phase composition on the properties of titanium carbide-steel cermets .... See Entry 68653

The effect of carbide volume fraction on the low stress abrasion resistance of high Cr-Mo white cast irons .... See Entry 68662

Scope for monitoring the thermomechanical hardening of steel from the martensite X-ray line intensity and shape .... See Entry 68709

Magnetoelastoacoustic method of nondestructive inspection of heat-treatment quality for steels .... See Entry 68743

81.40J Elasticity and anelasticity

(see also 62.20D Elastic constants, 62.40 Anelasticity, internal friction, and mechanical resonances)

68574 Uniaxial stress relaxation and creep behaviour in weldments of the pressure vessel steel A533B between 600 and 640°C. R.Otterberg (Swedish Inst. for Metals Res., Stockholm, Sweden).
Res Mech. (GB), vol.7, no.2, p.67-77 (1983).
In order to predict the stress reduction during stress relief heat treatment in welded joints of the pressure vessel steel A533B, uniaxial stress relaxation as well as creep tests were performed. The specimens were isothermally stress-relaxed between 600 and 640°C from initial stresses corresponding to specimen elongations of 0.25, 0.5 and 2.0%. The stress relaxation results are excellently described by a Norton relationship. The magnitude of the initial stress was found to affect the stress relaxation at the beginning of the tests, but after one hour the effect was very small. Creep strain data from creep tests in the specified temperature range were converted to describe stress relaxation behaviour as well. The results are used in an accompanying study in order to predict the multiaxial stress reduction in thick weldments of A533B steel. (3 refs.)

68575 Temperature dependence of dynamic & static Young's modulus of polymers. B.R.Yadav (Dept. of Phys., Government Girls Coll., Bilaspur, India), A.G.Dongaunkar.
Indian J. Pure & Appl. Phys., vol.20, no.12, p.988-9 (Dec. 1982). [received: April 1983]
Values of dynamic Young's modulus (Y_d) (ibid., vol.19, p.29, 1982) of some polymers obtained by cantilever dynamical methods are found 5 to 30% higher than that of the static Young's modulus (Y_s) (O'Dwyer J.J., The theory of electrical conduction and breakdown in solid dielectrics (Clarendon Press, Oxford), 1973) below room temperature; above room temperature the values are reversed after a cross-over. A critical temperature at which both the moduli have the same value has been found to depend on the material used. In the temperature range 0-30°C, values of Y_d are found to decrease linearly with increase in temperature whereas values of Y_s are almost constant in this temperature range; thereafter both the values fall rapidly. As compared to Y_d, the value of Y_s obtained by an electrical method depends more on internal disorder and molecular chain length. (6 refs.)

68576 The mechanical moduli of lamellar semicrystalline polymers. R.H.Boyd (Dept. of Chem. Engng., Univ. of Utah, Salt Lake City, UT, USA).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.493-504 (April 1983).
Bounds on the elastic constants are derived for semicrystalline polymers whose local morphology is lamellar. Local response matrices (stiffness and compliance) are formulated in three dimensions that simultaneously incorporate uniform in-plane strain and additive forces from layer to layer of crystalline and amorphous phases and uniform stress and additive displacements normal to the lamellar surfaces. Spatial averaging of the stiffness and compliance matrices under the assumption of axially symmetric orientation gives the upper and lower bounds on the longitudinal and transverse tensile moduli and the axial and transverse shear moduli as functions of the separate phase elastic constants, the volume percent crystallinity, and the moments of the orientation $\langle\cos^2\theta\rangle$ and $\langle\cos^4\theta\rangle$. The bounds are much tighter than the Voight upper and Reuss lower bands that do not recognise phase geometry. (22 refs.)

68577 The influence of low-temperature crystallisation on the tensile elastic modulus of natural rubber. A.Stevenson (MRPRA, Hertford, England).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.553-72 (April 1983).
When natural rubber crystallises at low temperatures, there is an increase in elastic modulus of up to two orders of magnitude. This phenomenon has been studied at various temperatures in the range 0 to −55°C for samples held at tensile strains of up to 500%. There is an induction period associated with the nucleation of crystallites before any increase in modulus is observed. The induction period increases with decreasing strain and passes through a minimum with increasing temperature at −25°C. The growth rate subsequent to nucleation is successfully described in terms of Avrami rate coefficient is independent of temperature and follows a simple exponential function of strain. The equilibrium extent of the modulus increase has also been studied by means of experiments of up to three months' duration. The equilibrium modulus increases with decreasing temperature—as predicted by Flory's thermodynamic theory. (43 refs.)

68578 Ionomeric blends. II. Compatibility and dynamic mechanical properties of sulfonated , cis-1,4-polyisoprenes and styrene/4-vinylpyridine copolymer blends. Z.-L.Zhou, A.Eisenberg (Dept. of Chem., McGill Univ., Montreal, Quebec, Canada).
J. Polym. Sci. Polym. Phys. Ed. (USA), vol.21, no.4, p.595-603 (April 1983).
Dynamic mechanical and optical transparency methods were used to investigate the compatibility of a series of blends of sulfonated cis-1,4-polyisoprene and styrene/4-vinylpyridine copolymers. It was found that compatibilisation occurs at a degree of substitution less than 5%. It is suggested that proton transfer from the sulfonic acid group to vinyl pyridine, which results in the generation of specific anion-cation interactions is responsible for the compatibilisation, since the removal of ionic interactions through esterification destroys the compatibility. (26 refs.)

68579 Viscoelastic analysis of glass-to-glass sandwich seals. G.W.Scherer (Corning Glass Works, Corning, NY, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.443-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A viscoelastic analysis of thermal expansion mismatch stresses in glass-to-glass sandwich seals is made. A simple expression is obtained that accurately

predicts the dependence of the setting temperature on the stiffness ratio of the seal. (4 refs.)

68580 Physical aging of glasses. K.L.Ngai, I.Manning (US Naval Res. Lab., Washington, DC, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.607-10 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
A model is presented which gives a unified description of the dispersion of relaxation times in the viscoelastic functions and the aging of viscoelastic properties of glasses and amorphous metals and polymers. The authors' treatment leads to a relaxation modulus of the form $G(t)=G_o \exp[-(t/\tau_p)^{1-n}]$, with $\tau_p=[(1-n)e^{n\gamma}E^n{}_c\ \tau_o]^{1/1-n}$. In their model aging effects are dominated by an increase of n as aging proceeds, resulting in a non-uniform shift of the entire spectrum of relaxation times. The model is consistent with recent experimental results of Chai and McCrum (1980) which impose a stringent demand on any treatment of viscoelastic aging. The class of compliance functions corresponding to the above relaxation modulus are evaluated and discussed. (12 refs.)

68581 Properties of stresses in composites with ribbon-like inclusions. S.Matysiak, Z.Olesiak (Uniwersytet Warszawski, Inst. Mech., Warsaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.397-408 (1981). In Polish.
A composite with rigid, ribbon-like fibres has been considered. The formulae have been derived for stress and displacements in the matrix surrounding a fiber in the case of tensile forces. The dependence on Poissons' ratio has been discussed and given in diagrams. The expression for energy density completes the paper. (10 refs.)

68582 Study of internal friction at high temperatures of high purity polycrystals and single crystals of nickel. A.Riviere, J.Woirgard (Lab. de Mecanique et de Phys. des Materiaux, ENSMA, Poitiers, France).
Scr. Metall. (USA), vol.17, no.3, p.269-73 (March 1983). In French.
In general, peaks are observed at 370-500K, 757K and 1120K. The amplitudes of these peaks varies considerably with the annealing temperature. The similarity between the behaviour of both types of crystal indicates that the phenomenon is not caused by relaxation at grain boundaries. It is suggested that the first peak is due to the cold working involved, and that the remaining peaks are stable features. (17 refs.) *N.C.*

68583 Some distinctive features of amplitude-dependent internal friction. V.A.Chelnokov, N.L.Kuz'min (M.I. Kalinin Polytech. Inst., Leningrad, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.10, p.1796-7 (Oct. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.10, p.3166-8 (Oct. 1982). [received: April 1983]
It is of interest to investigate the influence of grain size on both types of amplitude dependence of internal friction, measured both when the amplitude of oscillations was increasing and when it was decreasing. The authors have measured the decrement of oscillations by the method of damped oscillations of a freely suspended specimen effecting transverse oscillations at 400 Hz. The measurements were performed on AV-1 (99.7%) aluminum. The grain size was altered by successive recrystallization anneals after small preliminary deformations. It was thus possible to study the internal friction in one specimen successively for several grain diameters and in this way the influence of possible scatter in the chemical composition on the results of the measurements was reduced. (8 refs.)

68584 Mechanical properties of Cu-based composites with in situ formed ultrafine filaments. J.Bevk, W.A.Sunder (Bell Labs., Murray Hill, NJ, USA), G.Dublon, D.E.Cohen.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.121-33
Elastic and plastic properties of in situ Cu-based composites with Nb, V, and Fe filaments are reviewed. The evidence is presented for a pronounced size dependence of both the ultimate tensile strength and the Young's moduli. In composites with the smallest filaments (d~500-200Å) and filament densities as high as $10^{10}/cm^2$ dislocation density reaches values of 10^{13} cm/cm^3. The yield stress of these samples increases dramatically over the predictions based on the 'rule of mixtures' and their ultimate tensile strength approaches the estimated theoretical strength of the material (~2.7 GPa). The observed decrease of Young's modulus as a function of inverse wire diameter in the as-drawn composites is attributed to lattice softening due to high density of extended lattice defects. Upon annealing, Young's modulus increases by as much as 100% and exceeds the maximum values calculated from bulk elastic constants. Possible mechanisms leading to modulus enhancement and to related changes in magnetic and superconducting behavior of in situ composites are discussed. (14 refs.)

Averaged equations of the theory of elasticity of matrix composites .... See Entry 66469

Epon 828 epoxy: a new photoelastic-model material .... See Entry 66530

Radiation-induced crystallinity changes in linear polyethylene .... See Entry 67049

Effective elastic properties of axial textures .... See Entry 67088

New third-order bounds on the effective moduli of N-phase composites .... See Entry 67089

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep .... See Entry 67100

Elastic anisotropy and phonon dispersion effects in iron and tungsten .... See Entry 67131

Effect of relaxation of transformation stresses on the martensite points .... See Entry 68543

Influence of elastic stress on the formation of cubic and axial $\{hk0\}\langle 001\rangle$ texture in 3% ferrosilicon .... See Entry 68555

On some micromechanism of memory of metals in the case of nonstationary processes of deformation in the thermal activation range .... See Entry 68585

Tensile creep and relaxation of the lamellar Al-Al_2Cu composite. Experiments on the tensile stage of a high voltage transmission electron microscope (HV TEM) .... See Entry 68612

A correlation law for steady state creep and stress relaxation tests on the Al-Al_2Cu composite .... See Entry 68613

Dynamic fatigue of sodium-silicate glasses with high water content .... See Entry 68637

81.40L Deformation, plasticity and creep

(see also 62.20F Deformation and plasticity, 62.20H Creep)

68585 On some micromechanism of memory of metals in the case of nonstationary processes of deformation in the thermal activation range. A.Blinowski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.1, p.39-48 (1982).
An idealized model of transient dislocation motion in a stress field has been analyzed. This motion was produced by the generation of kink pairs and their migration along a dislocation line. Transient processes associated with violent changes of strain conditions in the material have been discussed and small deviations from the steady process have been analysed considering the elastic strain component for a given strain rate. (8 refs.)

68586 On a model for the study of redistribution of residual microstresses during complex loading of polycrystalline metals. W.Szczepinski (Inst. of Fundamental Technol. Res., Polish Acad. of Sci., Warsaw, Poland).
Arch. Mech. (Poland), vol.34, no.1, p.105-16 (1982).
A simple structural model of polycrystalline aggregate composed of two kinds of elements of different shape forming a regular structure is considered. Due to the stress concentration in the elastic state caused by special configuration, elements of one family begin to deform plastically at a certain level of loading, while elements of the other family remain elastic. This model allows the author to study the redistribution of microstresses during complex plastic deformation process. As an illustration, a process of complex cyclic loading is analyzed. (22 refs.)

68587 Stabilization of copper alloys by heat treatment. D.Arnaud (Centre Tech. des Industries de la Fonderie, Paris, France).
Fonderie - Fondeur d'Ajourd'hui (France), no.22, p.43-6 (Feb. 1983). In French.
Solidification and cooling stresses can be reduced or eliminated by heat treatment. Curves have been plotted which make it possible to evaluate the influence of annealing on the elimination of internal stresses in high-strength brasses, bronzes and aluminium-bronzes. (8 refs.)

68588 Alterations in the microstructure of 304 stainless steel produced by small strain deformation at ambient temperature. M.E.Kassner (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Res Mech. (GB), vol.7, no.2, p.79-84 (1983).
AISI 304 stainless steel specimens were deformed at ambient temperature and a low (10^{-3} s^{-1}) strain rate to strains less than 0.10. The microstructures of the specimens were then characterised under a transmission electron microscope. The results suggest that 304 stainless steel deformed within this regime possesses microstructures different from those widely reported. It appears that any ambient temperature deformation introduces microtwins within at least some grains. (13 refs.)

68589 Superplasticity: a review of data. J.Gittus (UKAEA, Harwell, England).
Res Mech. (GB), vol.7, no.3, p.127-201 (1983).
A review is presented of experimental information on superplasticity in metals and alloys. These materials fall into two main categories: those in which a fine grain-size is stabilised during deformation by grain boundary precipitates and those in which a sizeable fraction of the specimen comprises particles of a second phase. In either case it is the existence of a fine grain-size that permits superplastic deformation to occur. The process is one in which the grains flow like grains of sand. Each grain accomplishes small, fluctuating changes of shape in order to prevent the opening-up of grain boundary cavities as deformation proceeds. It seems likely that most crystalline solids could be made to exhibit superplasticity providing that the requisite structure can be produced and retained during deformation. (139 refs.)

68590 Necking and deformation behavior of locally annealed aluminum sheets in simple tension. K.Manabe, H.Nishimura (Tokyo Metropolitan Univ., Tokyo, Japan).
Bull. JSME (Japan), vol.26, no.212, p.194-201 (Feb. 1983).
Low ductility metals are known to have ductility improved by composing with high ductility metals in layers, for example, cladding metals. The purpose of this investigation is to clarify the formation of mechanism of ductility enhancement in such metals. Simple tension tests are performed on aluminum sheets which are locally annealed by using a high frequency induction heating device and have hardness distribution in width direction. A geometrical model for the necking pattern is proposed, and the effects of annealed width on limit elongation and on the angle, pitch and pattern of necking are discussed in detail. Comparisons are made between the center and the edge annealed sheets. It is clearly demonstrated that the limit elongation and the ultimate strengh of such composite metals can be assessed by applying Swift's instability criterion (maximum load condition) to the total load. (6 refs.)

68591 Effect of the type of pre-torsional deformation on the creep rate of a silver-copper alloy. G.A.Hassan (Metal Phys. Lab., Nat. Res. Centre, Dokki, Egypt), H.H.Hassan.
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.144-5 (April 1983).
In the course of a previous study (G.A. Hassan, 1979) on the effect of bidirectional torsion on the creep rate, it was noted that the creep rate of polycrystalline aluminium wires showed significant sensitivity to the type and degree of pre-deformation. In the present work the study is extended to silver-0.3 wt.% copper wires which are pre-torsionally deformed. Room temperature creep curves for pre-twisted samples are compared with those for annealed (undeformed) ones. It is found that the type and angle of pretorsional deformation affected the creep rate of the alloy samples under investigation. (5 refs.)

68592 The effect of molybdenum in Type 316 stainless steel on grain boundary self-diffusion and creep rate at low stresses. H.Jones (Dept. of Metall., Univ. of Sheffield, Sheffield, England).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.146-8 (April 1983).
The strain rate per unit stress S sustainable in creep is $S=A[D_GS/kT][\Omega/L^3]$ where A is a numerical factor, D_GS is the product of grain boundary self-diffusion coefficient D_G and grain boundary width S, Ω is atomic volume, L is grain diameter, k is Boltzmann's constant and T is temperature in K. Observed S for Type 316 steel was a factor of 4 to 6 out on predictions of this equation. The possibility that the presence of Mo in this steel could be affecting D_GS was examined. (23 refs.)

68593 Low thermal contraction GFRP. K.Kadotani, F.Aki (Hitachi Res. Lab., Hitachi Ltd., Ibaraki, Japan).
Cryogenics (GB), vol.23, no.5, p.267-70 (May 1983).
Glass fibre reinforced plastics (GFRP) with low thermal contraction and high compressive strength are reported. The linear thermal contraction from 300K to 77K in the direction normal to the plane of the laminations is the same as that of the superconductor. Ultimate compressive strength at 300K is more than 800 MPa. These high-density voidless GFRP are suitable for spacers in large superconducting coils. (2 refs.)

68594 Variability in mechanical performance of G-10CR cryogenic-grade insulating laminates. M.B.Kasen, R.E.Schramm (Fracture & Deformation Div., NBS, Boulder, CO, USA).
Cryogenics (GB), vol.23, no.5, p.279-80 (May 1983).
An assessment is made of the variability in cryogenic mechanical performance of insulating laminates produced by five manufacturers to a common component and procedure specification. Results at 295K and 76K indicate that the specification is adequate to ensure the desired degree of product uniformity. (2 refs.)

68595 Effect of ion implantation on creep of molybdenum. I.W.Hall (Dept. of Mech. & Aerospace Engng., Univ. of Delaware, Newark, DE, USA).
Int. J. Refract. & Hard Met. (GB), vol.2, no.1, p.27-31 (March 1983).
Thin sheet specimens of molybdenum have been ion implanted and subjected to creep testing. The results indicate that the effect of ion implantation is very dependent upon the ion type and the subsequent conditions of testing. Heavy-ion implantation can cause accelerated creep whereas implantation with carbon ions can cause a pronounced decrease in creep rate within the range of experimental conditions investigated. The results are considered in terms of the radiation damage arising from the implantation process and the microstructures observed by transmission electron microscopy. (7 refs.)

68596 Microplasticity and strength of Mn-Zn ferrites. A.M.Savel'ev, A.P.Korolev, V.P.Shelokhvostov, S.P.Travkin (Tambov Chem.-Engng. Inst., Tambov, USSR).
Ind. Lab. (USA), vol.48, no.7, p.726-30 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.79-81 (July 1982). [received: March 1983]
Methods of static bending and microhardness were used to investigate the features of microplastic deformation and its time relationship for polycrystalline Mn-Zn ferrite. Also investigated was the influence of residual elastic stresses on the microstrength. (4 refs.)

68597 Temperature dependence of $\{11\bar{2}2\}\langle\bar{1}\bar{1}23\rangle$ slip in zinc. H.Tonda (Dept. of Metall., Kumamoto Univ., Kumamoto, Japan), T.Kawasaki.
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.284-93 (April 1983). In Japanese.
The tensile deformation behavior of zinc thin sheet crystals was investigated in the temperature range from 207 to 333K. The tensile axis of specimens is parallel to $\langle 11\bar{2}0\rangle$, and the surface is parallel to $\{0001\}$ (A specimens) or $\{10\bar{1}0\}$ (B specimens). B specimens showed such anomalous dependence that the yield stress increased from 11 to 13 MPa with increasing temperature, in contrast with the yield stress of A specimens decreasing from 13 to 9 MPa. The length of slip bands which appeared just after yielding decreased from 3 to 0.3 mm, and the mean free path of edge dislocations evaluated by the etch pit technique decreased from 300 to 10 μm with increasing temperature. The stress-strain curves of both A and B specimens exhibited stage I having the small work hardening ratio and then stage II having the large ratio. Stage II began just after the bundle of slip bands widening with strain, filled up the whole of specimen. With increasing temperature, the strain of stage I decreased and the work hardening ratio at stage II increased rapidly. (17 refs.)

68598 Deformation in 30% cold-rolled Cu-30Zn brass grains. D.K.Paik (Coll. of Engng., Ajoo Univ., Suwon, Korea).
J. Korean Inst. Met., vol.20, no.12, p.1079-85 (Dec. 1982). In Korean.
From slip traces produced by microhardness indentation, orientation of grains in a commercial Cu-30Zn brass has been determined before and after rolling reduction of 30% at room temperature. Different deformation structures were observed on grains, where the Schmid factor analysis shows that they depend on the number of active slip systems at rolling. When the primary slip system is unique, deformation is homogeneous, but when more than one slip system are equally active, deformation is heterogeneous; in particular, large, distinct subgrains can be formed. It was also observed that when a twin axis is parallel to the transverse direction regions contiguous to the twin boundary rotate together, thus remaining a narrow band of twin couple after rolling. From these observations, it was concluded that slip mechanism, during the first stage of cold-rolling, may include (1) multi-directional rotations on the same grain and (2) a binding force of the twin boundary on contiguous regions. (7 refs.)

68599 On the adiabatic shear of Ti-6Al-4V ballistic targets. Y.Me-Bar, D.Shechtman (Dept. of Materials Engng., Technion-Israel Inst. of Technol., Haifa, Israel).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.181-8 (April 1983).
Ballistic targets made of Ti-6Al-4V, which had undergone various heat treatments, were impacted by 7.62 mm armour piercing bullets, thus being subjected to strain rates of about 3×10^{5} s^{-1}. The adiabatic shear bands formed thereby were examined using optical and transmission electron microscopy. The high temperatures generated at the shear band can cause transformation from the α phase to the β phase and may lead to melting in some cases. The rapid cooling of the highly deformed shear bands was of the order of 10^{7}°C s^{-1}. This extremely high rate produced a very fine transformed structure. Bands that melted on heating differed from those whose temperature rose only to the β region. In the former all previous features have disappeared; in the latter the primary β lamellae were preserved and they served to indicate the direction and extent of the shear at any point within the band. In both cases the transformation products are harder than the base material. (7 refs.)

68600 Strain-temperature correlations obtained in rolling. A.P.Singh, S.Venkadesan, K.A.Padmanabhan (Dept. of Metall., Indian Inst. of Technol., Madras, India).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.223-7 (April 1983).
The conclusion of an earlier study (Singh and Padmanabhan, ibid., vol.51, p.137, 1981) involving upsetting, the fact that the strain ϵ_{st} necessary for obtaining a given grain size at any temperature decreased exponentially with the absolute temperature of deformation, was verified also for rolling using a low alloy steel and electrical grade aluminium. It was found that, in order to achieve good correlation between the upsetting and rolling results, the rolls had to be preheated by 100K and the heating temperature for rolling should be maintained at 50K above the corresponding temperature for upsetting. (18 refs.)

68601 Substructure and back stress changes resulting from the cyclic loading of $2^{1}/_{4}$Cr-1Mo steel at 755K. K.D.Challenger, P.G.Vining (Naval Postgraduate School, Monterey, CA, USA).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.257-67 (April 1983).
The effect of cyclic loading wave shapes on the cyclic stress-strain behavior and the dislocation-precipitate substructure has been studied for 2.25Cr-1Mo steel tested at 755K. Asymmetric loading (constant-strain dwell periods at only one strain limit) creates a higher dislocation density than does symmetric loading (continuous cycling or constant-strain dwell periods at both strain limits). The dislocations are tangled around M_2C particles for the asymmetric loading and more uniformly dispersed for the symmetric loading. The loading wave shape is shown to have a more significant effect on the dislocation density than does the plastic strain range. The carbides present in the alloy are very stable as no change are observed after up to 2000 h of cyclic loading at 755K. The back stress, as measured from hysteresis loops, was found to decrease during constant-strain hold periods, resulting in a reduction in the Bauschinger effect following a dwell period. The results are explained by a difference in the effective strength of dislocation barriers when asymmetric loading is employed. (20 refs.)

68602 Influence of temperature and stretching rate on the strength of polyester fibres of small elongation. A.Wrochowicz, M.Linek (Inst. Wlokienniczy, Filia Politech. Lodzkiej, Bielsko-Biala, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.239-52 (1981). In Polish.
The modification of the Zurkov equation (1961, 1962) widening the range of its application for materials characterized by strong flow during stretching is described. For such materials the structural coefficient γ is stretching rate and temperature-dependent. This results in loss of material strength with rise in stretching rate, when the stretching rate reaches a high value, and the temperature dependence is considerably greater than assumed by Zurkov. Moreover, the effect of intermolecular bounds on stress transfer in material, responsible for linear loss in the activation energy of destruction with increase in temperature, has been taken into account. The analyses of the Zurkov equation have been confirmed from data of measurements carried out on polyester fibres of small elongation. (25 refs.)

68603 On dilatation and plastic flow in metallic glasses. P.E.Donovan, W.M.Stobbs (Dept. of Metall. & Materials Sci., Univ. of Cambridge, Cambridge, England).
Philos. Mag. A (GB), vol.47, no.4, p.537-46 (April 1983).
A modification of the free-volume theories of plastic flow in metallic glasses is considered which takes into account hydrostatic stresses. It is shown that this provides a qualitative explanation of many aspects of the observed behaviour of these materials. (34 refs.)

68604 The influence of trace additions of zirconium on diffusional creep in Ni-20% Cr. J.H.Schneibel, G.F.Petersen (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Scr. Metall. (USA), vol.17, no.3, p.353-8 (March 1983).
The diffusional creep properties of Ni-20% Cr and Ni-20% Cr-0.11% Zr were investigated both in the Coble creep and the Nabarro-Herring creep regime. Whereas zirconium has little, if any, influence on bulk diffusion in Ni-20% Cr it slows down the grain boundary diffusivity by approximately a factor of 10. The pronounced effect of zirconium may be caused by strong segregation at the grain boundaries. Both the solid solubility of zirconium in Ni-20% Cr and the zirconium-induced grain boundary diffusivity change suggest that approximately half a monatomic layer of zirconium could be segregated at the grain boundaries. (18 refs.)

68605 Bauschinger effect in a dual-phase steel. A.Goel, R.K.Ray, G.S.Murty (Dept. of Metall. Engng., Indian Inst. of Technol., Kanpur, India).
Scr. Metall. (USA), vol.17, no.3, p.375-80 (March 1983).
A dual-phase steel containing 1.5%Mn, 1.5%Si and 0.09%V was investigated in order to measure quantitatively the Bauschinger effect as a function of volume fraction of martensite and the tensile prestrain. It was found that the Bauschinger effect increases with increasing martensite volume content of about 20%, beyond which it decreases. Both the long-range back-stress and Bauschinger strain increases with increase in the tensile prestrain. Long-range back-stresses exerted by the dislocations around the martensite islands are probably responsible for the Bauschinger effect in this alloy. (2 refs.)

68606 Shape memory effect in the vanadium-hydrogen system. L.S.Bushnev, L.P.Kitaeva (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.713-16 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.38-43 (Aug. 1982). [received: April 1983]
The shape memory effect (SME) has been investigated in alloys of the V-H system at concentrations in the range 0.2-0.5 H/V. It is shown that SME occurs over the entire H/V range indicated, but the magnitude of the stresses, the reversibility of the deformation during heating, as well as the magnitude of the thermal hysteresis depend essentially on the hydrogen concentration. The conclusion is drawn that the transformation in this system is of a martensitic character. (9 refs.)

68607 Concentrational and temperature dependence of the physical yield point of FCC polycrystals of copper solid solutions. E.F.Dudarev, L.A.Kornienko (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).
Sov. Phys. J. (USA), vol.25, no.8, p.741-5 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.69-74 (Aug. 1982). [received: April 1983]
Although the nature of the yield point of FCC polycrystals of substitutional solid solutions is a question that has been under discussion for a long time, until recently there was no single view regarding the structural factors that determine its concentrational and temperature dependence. This is mainly because, in constructing theories of the yield point of polycrystals and analyzing experimental data, no account was taken of the specific features of the development of plastic deformation at the yield point and with stresses below the yield point, i.e. in the region of microplastic deformation. The present work is a continuation of earlier investigations on the principles underlying the mechanism of microplastic deformation of FCC polycrystals of substitutional solid solutions. (12 refs.)

68608 Consideration of anisotropy parameters in polycrystalline metals. P.I.Welch, L.Ratke, H.-J.Bunge (Inst. fur Metallkunde & Metallphys., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Z. Metallkd. (Germany), vol.74, no.4, p.233-7 (April 1983).
The concept of the strain ratio is discussed both theoretically and experimentally. It is found that the *r*-value as defined in various Standards is unsuitable both as an integral measure of plastic anisotropy over a range of strain and as a strain dependent variable. As a measure of the instantaneous anisotropy the parameter *p* is found to be theoretically sound and practically measurable. As an integral measure of plastic anisotropy over a desired strain range, as required in formability analysis, the integral of *p*, *P*, is found most suitable. The slop of a linear fit to the width strain/thickness strain data is found to give an accurate approximation to *P* if the fit is carried out over the same strain range. This quantity is easier to measure. Experimental results are presented which demonstrate the theoretical conclusions reached. (16 refs.)

68609 Transverse mechanical behavior of high-strength monocarbide eutectics. M.F.X.Gigliotti,Jr., M.R.Jackson, S.W.Yang, M.F.Henry, D.A.Woodford (Corp. Res. & Dev., General Electric Co., Schenectady, NY, USA).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.21-9
Superalloy eutectics strengthened with monocarbide whiskers are highly anisotropic in strength. Mechanical behavior transverse to the growth axis is governed largely by the fracture resistance of the matrix grain boundaries. While the matrices of these eutectics are essentially columnar grained superalloys, there are significant differences between DS superalloys and superalloy-monocarbide eutectics. These differences arise, in part from different soli-

dification processes and from the alloying limitations in eutectic systems. A study is made of transverse mechanical strengths of a series of monocarbide reinforced eutectic superalloys whose alloy matrix compositions range from high to low gamma prime content, and have intentional minor element additions of Hf, La, and B. (no refs.)

68610 The quaternary system Fe-Cr-Mn-C and aligned ferrous superalloys. F.D.Lemkey, E.R.Thompson (United Technologies Res. Center, East Hartford, CT, USA), J.C.Schuster, H.Nowotny.
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.31-50
The constitution of the quaternary, Fe-Cr-Mn-C, and to a lesser extent the quinary, Fe-Cr-Mn-Al-C, systems were examined for in situ composite alloy candidates. Multivariant eutectic compositions, determined from phase equilibria, were directionally solidified to produce aligned composites consisting of M_7C_3 carbides with a gamma iron matrix. The composition and lattice parameters of the carbide and matrix phases were determined to establish their respective stabilities. Stress rupture tests in the direction of phase alignment for certain compositions (e.g., Fe-20 wt.% Cr-10 wt.% Mn-3.2 wt.% C) indicated strength values comparable to cast nickel-base superalloys and exceeded those of the strongest iron-nickel superalloys developed for automotive turbines. Results of cyclic sulfidation testing at 900° indicated a balance of Cr and Al content to be important to the achievement of outstanding surface stability. (51 refs.)

68611 Off-axis tensile properties of γ/γ'-αMo DS eutectic. Z.Q.Hu, J.H.Zhang, Y.B.Xu, Z.Y.Zhang, Y.S.Zhang, Y.J.Tang (Inst. of Metal Res., Chinese Acad. of Sci., Liaoning, China).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.51-8
Reports a study of off-axis tensile properties of γ/γ'-αMo DS eutectic and the dynamic fracture process directly observed with a scanning electron microscope. If the loading direction deviates from the Mo fiber growth direction, the tensile strength and ductility decrease gradually. During the loading process, two types of cracking are observed: one is cracking of the fiber, and the other is delamination along the fiber-matrix interface. In plastic deformation, slip can pass through both the matrix and the fiber. As a rule, the thicker fibers are cracked earlier than the thinner ones, because they have less defects and better ductility. Delamination is the main source of final fracture. (7 refs.)

68612 Tensile creep and relaxation of the lamellar Al-Al_2Cu composite. Experiments on the tensile stage of a high voltage transmission electron microscope (HV TEM). M.Ignat, D.Caillard (Domaine Univ., Saint Martin d'Heres, France).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.115-19
Because of the lamellar microstructure, and also because of its defects, the local stresses are quite different from those of a normal tensile test. They are imposed by accommodation requirements at the various interfaces. The macroscopic deformation of a sample is a result of several deformation zones which depend on the distribution of lamellar defects. During plastic deformation, several mechanisms act simultaneously and their activation depends principally on temperature. During the tests performed in the high voltage electron microscope, the same type of mechanisms is observed in creep and in stress-relaxation tests. Nevertheless comparing these test substructures to the macroscopic test substructures, it is observed that in thin foils obtained from the macroscopic tests the dislocation substructure was denser for the stress-relaxation tests. This is in agreement with the fact that at constant temperature, the initial relaxation stress was always higher than creep stress, consequently the fixed initial strain was greater. (12 refs.)

68613 A correlation law for steady state creep and stress relaxation tests on the Al-Al_2Cu composite. M.Ignat, R.Bonnet, F.Durand (Domaine Univ., St. Martin d'Heres, France).
In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.135-41
Deformation by creep or by stress-relaxation involves similar thermally activated phenomena. In particular microstructural observations on the Al-Al_2Cu lamellar composite illustrated the importance of the interphase accommodation mechanisms, especially movements of linear defects at the phase boundaries. Experimental results have shown that the asymptotic stress measured in stress-relaxation tests takes the same value as the threshold stress limiting the steady state creep domain. From this finding a simple Bingham rheological model was developed in which a temperature dependent threshold stress is combined with a generalized Dorn viscosity law. The model correlates satisfactorily the results of both steady state creep tests and the results of stress-relaxation tests. The calculated activation energy and stress exponent are compared with the values deduced from physical models of deformation accommodation through grain boundary sliding. (18 refs.)

Numerical treatment of the cladding mechanics in the fuel rod computer code IAMBUS .... See Entry 65311

Irradiation creep in the fusion reactor first wall .... See Entry 65666

Experimental study of inelastic strain patterns in a model of a tube-plate ligament using an interferometric moire technique .... See Entry 66529

Powder neutron diffraction study of nickel-titanium martensite .... See Entry 66936

The effect of UV irradiation on films made of PVC containing small amount of modifying copolymers .... See Entry 67037

Radiation-induced crystallinity changes in linear polyethylene .... See Entry 67049

Anisotropic yield surfaces in cyclic plasticity .... See Entry 67095

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep .... See Entry 67100

The surface energy of zinc .... See Entry 67339

Influence of the normal phase concentration and morphology on the superconductor flow stress .... See Entry 67844

Mechanical and superconducting properties of Cu-Nb_3Sn in situ produced composite wires .... See Entry 68480

The influence of alloy chemistry on controlling fiber volume fraction in Ni-base MC aligned eutectics .... See Entry 68509

Fine-grain iron-silicon and iron-silicon-aluminum alloys obtained by cooling from the liquid state .... See Entry 68526

Influence of small deformations on the stability of fine-grain structure in the alloy Fe-3% Si .... See Entry 68557

A theory of non-linear anisotropic hardening .... See Entry 68559

An X-ray diffraction study of lattice imperfection in cold-worked FCC alloys. IV. Copper-germanium (alpha-phase) .... See Entry 68560

The work-hardening behaviour of hydrogen-charged high purity iron single crystals at temperatures between 296 and 200K .... See Entry 68562

Work hardening and dynamical recovery in silicon and germanium at high temperatures and comparison with FCC metals .... See Entry 68563

Hot rolling of Sendust .... See Entry 68569

Effect of composition on deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust .... See Entry 68570

The high temperature degradation of Cd-Zn and Pb-Cd eutectic alloys .... See Entry 68572

Uniaxial stress relaxation and creep behaviour in weldments of the pressure vessel steel A533B between 600 and 640°C .... See Entry 68574

Mechanical properties of Cu-based composites with in situ formed ultrafine filaments .... See Entry 68584

Influence of an overload on the fatigue crack growth in steels .... See Entry 68618

On the relation between stable crack growth and fatigue .... See Entry 68620

On life time predictions with the strain range partitioning method .... See Entry 68623

Brittleness of Sendust .... See Entry 68627

Plasticity and fracture of inorganic glasses at high speed grinding .... See Entry 68636

Fracture surfaces and mechanical properties of tungsten heavy metals .... See Entry 68645

Effects of cold rolling and annealing on the mechanical properties of 90W-7Ni-3Fe heavy alloys .... See Entry 68654

Correlation of erosion with mechanical properties in metals ... See Entry 68668

Depassivation of iron by straining and by abrasion: an a.c. impedance study .... See Entry 68685

Carburizing of dual-phase steel .... See Entry 68693

A statistical method of determining the early signs of necking .... See Entry 68715

Comments on: deformation twins in punched specimens of a 321 steel .... See Entry 68739

Deformation in punched specimens of type 304 stainless steel .... See Entry 68740

81.40N Fatigue, embrittlement, and fracture

(inc. hardness; see also 62.20M Fatigue, brittleness, fracture and cracks)

68614 Observations of cyclic grain boundaries migration in aluminium after large numbers of fatigue cycles. V.Raman, T.G.Langdon (Dept. of Materials Sci. & Mech. Engng., Univ. of Southern California, Los Angeles, CA, USA).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.180-2 (April 1983).
Polycrystalline aluminium is found to exhibit a one-to-one correspondence between grain boundary migration markings and the number of fatigue cycles for up to at least 150 cycles. The occurrence of migration introduced the possibility of grain growth if small grains disappear in the migration process. By using interferometry, it is shown that grain boundary sliding occurs during each cycle of migration. (11 refs.)

68615 Non-conventional tungsten-base hard metal. H.Sheinberg (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Int. J. Refract. & Hard Met. (GB), vol.2, no.1, p.17-26 (March 1983).
A novel hard metal composition comprising borides and carbides of tungsten, nickel, and iron is made by reaction hot pressing mixtures of elemental tungsten, nickel, and iron powders with small quantities of boron carbide. The hardness of these compositions is in the range of the hardest conventional tungsten carbide-cobalt compositions. It was subsequently determined that molybdenum can be substituted for all the tungsten in the composition, and elemental boron can be substituted for the boron carbide with a minimum reduction in hardness. The new composition can be used in high-pressure anvils; it sustains higher pressures than commercial carbides without plastic deformation. (2 refs.)

68616 Fracture toughness of hardened cement paste and concrete. I.A.Pathan (Mehran Univ. of Engng. & Technol., Jamshoro, Pakistan).
Mehran Univ. Res. J. Eng. & Technol. (Pakistan), vol.1, no.4, p.7-13 (Oct. 1982). [received: April 1983]
The single edge cracked specimens of hardened cement paste and concrete were tested to failure in direct tension. The fracture toughness was calculated by using equations of linear elastic fracture mechanics. The results indicate that the fracture toughness of hardened cement paste is constant for various depths of the induced crack and is a material property; while the fracture toughness of concrete increases with the increasing depth of the induced crack up to some critical value. (15 refs.)

68617 Assessment of the susceptibility to hydrogen embrittlement with an original specimen. I. Effect of heat treatment on delayed failure time of 38 NiCrMo 4 steel. R.Fratesi, G.Roventi, F.Veniali (Dipartimento di Sci. dei Materiali e della Terra, Univ. di Ancona, Ancona, Italy).
Mater. Chem. & Phys. (Switzerland), vol.8, no.2, p.179-87 (Feb. 1983).
Delayed failure tests, in which suitable samples were cathodically charged with hydrogen (current density 8 $mA.cm^{-2}$) in 0.1 N sulphuric acid, while under sustained tensile loads, were conducted upon a low alloy Ni-Cr steel (UNI 38 NiCrMo 4) with different conditions of heat treatment. The satisfactory reproducibility of the experimental results have indicated the suitability both of the method used and the test specimen shaped to prevent stress concentration and mechanical and/or electrochemical cracking. (12 refs.)

68618 Influence of an overload on the fatigue crack growth in steels. C.Robin, M.Louah, G.Pluvinage (Lab. de Fiabilite Mecanique, Faculte des Sci., Metz, France).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.1-13 (1983).
Concerns the influence of a single-peak overload and the overload ratio on the subsequent rate of growth of a fatigue crack in steels. Retardation increases with increasing overload ratio. The crack opening load was also measured during all tests. It is shown that the Elber's crack closure concept is not able to explain the effect of overloads. The importance of the material yield stress was evaluated by testing steels of different strength. It seems that the residual stress state induced by the overload is the major factor causing retardation. Two models are analyzed. (17 refs.)

68619 The effect of environment on the growth of small fatigue cracks. J.Lankford (Southwest Res. Inst., San Antonio, TX, USA).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.15-31 (1983).
The growth of 'large' and 'small' cracks in 7075-T6 aluminum is characterized in moist air and dry nitrogen. It is found that in both environments, the small cracks grow faster than large ones, but unlike large cracks, which grow much faster in air than in nitrogen, the small cracks extend in each environment at about the same average rate. The absence of environmental effect is found to be only apparent, a change to an inherently slower mode of growth in air offsetting the crack-accelerating influence of moisture. Subsurface grain boundaries apparently retard microcrack growth in both environments. Possible rationales for the rapid growth of small cracks are discussed. (19 refs.)

68620 On the relation between stable crack growth and fatigue. S.Kaiser (Dept. of Strength of Materials & Solid Mech., Royal Inst. of Technol., Stockholm, Sweden).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.33-49 (1983).
Fatigue crack growth in the intermediate range can be described by the Paris law of linear elastic fracture mechanics. However, if gross plastic deformation is involved, the crack growth rate is often underestimated by LEFM. The increased crack growth rate due to plastic deformation was determined by using the *J-R* curve. This model was found to give very good results over a wide range of high crack growth rates for three different geometries of two different steels. A way to predict instability under controlled cyclic load is discussed and is proved to work well in practice. Instability under displacement control is also discussed. (9 refs.)

68621 Slow fatigue crack growth and threshold behaviour in IMI 685. M.A.Hicks, R.H.Jeal (Materials Engng. Group, Rolls-Royce Ltd., Derby, England), C.J.Beevers.
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.51-65 (1983).
Fatigue thresholds and crack growth rates up to 10^{-4} mm cycle^{-1} have been measured in β processed IMI 685. The results obtained in laboratory air for material having an aligned α microstructure and a random basketweave microstructure displayed a pronounced load ratio dependence which increased with decreasing ΔK. This sensitivity to mean load was also apparent from the threshold results determined in a vacuum of 5×10^{-6} torr. Fractographic observations, compliance measurements, pd output and crack path replication have indicated that contacts can be made between the fracture faces at a number of points behind the crack tip during the load cycle. These contacts wedge the crack open, thus preventing the stress intensity from falling to the value associated with the minimum applied load. A critical stress intensity, K_{op}, has been determined which relates to the crack being fully 'open' and the results are reanalysed and discussed in terms of an effective stress intensity range, ΔK_{eff}. (29 refs.)

68622 A study of short fatigue crack growth behaviour in titanium alloy IMI 685. C.W.Brown, M.A.Hicks (Materials Engng. Group, Rolls Royce Ltd., Derby, England).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.67-76 (1983).
The fatigue growth of short cracks in coarse grained IMI 685, having an aligned α microstructure, has been monitored using a two stage replication technique. Crack growth rates are presented in terms of the failure mechanism and compared with standard data obtained from through cracked, compact tension specimens. The maximum difference, of up to four orders of magnitude, between long and short crack growth rates is associated with separation along specific crystallographic planes resulting in a cleavage-like fracture appearance. The rate of short crack growth is also shown to be dependent on applied stress and a dwell at maximum load during the fatigue cycle. (25 refs.)

68623 On life time predictions with the strain range partitioning method. W.Hoffelner, K.N.Melton, C.Wuthrich (Brown, Boveri & Co. Ltd., Baden, Switzerland).
Fatigue Eng. Mater. & Struct. (GB), vol.6, no.1, p.77-87 (1983).
Computer optimization techniques were applied to the strain range partitioning method for life time prediction under high temperature low cycle fatigue loading. The experimental data were evaluated using a simultaneous parameter fit determination of the baseline coefficients. This approach gave good predictions whereas a more conventional method did not work. The significance of the linear damage rule and the interaction damage rule is discussed on the basis of a generalised rule containing both as special cases. This formalism was applied to a ferritic steel and a cast nickel base-superalloy. In both cases a very good agreement between calculated and measured lifetimes was found. (13 refs.)

68624 The selection of crack path on fatigue crack propagation in dual phase steels. T.Ishihara (Aero-Engine & Space Operations, Ishikawajima-Harima Heavy Industries Co. Ltd., Tokyo, Japan).
Int. J. Fract. (Netherlands), vol.22, no.1, p.R31-2 (May 1983).
A study has been made on selection of crack path on fatigue crack propagation in dual phase microstructures in which the martensitic phase encapsulated islands of ferritic phase are in association with the cleavage cracking of ferrite (grains). (3 refs.)

68625 Hydrogen embrittlement of yttrium. C.V.Owen, T.E.Scott (USDOE, Iowa State Univ., Ames, IA, USA).
J. Less-Common Met. (Switzerland), vol.90, no.2, p.275-82 (April 1983).
The mechanical properties of yttrium containing 0.23, 5.03, 11.7 and 16.3 at.% H were investigated from 78 to 473K. Hydrogen caused strengthening at temperatures below about 295K. Furthermore, anomalous behavior of both the strain-hardening exponent and the strain rate sensitivity parameter occurred at this temperature when hydrogen was added to yttrium. Sharp ductile-to-brittle transitions were observed in the material containing 11.7 and 16.3 at.% H. Supporting evidence and experimental results are presented which show that hydrogen in solution can embrittle yttrium. (20 refs.)

68626 Intergranular fracture of high purity iron due to oxygen. H.Matsui, H.Kimura (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.294-300 (April 1983). In Japanese.
A high purity iron, prepared in the form of smooth wire, does not show IGF in a tensile test at 4.2K. Polycrystalline specimens of this iron was doped with oxygen; a thin oxide film was formed on the surface and a concentration (<several mass ppm) of oxygen was dissolved in equilibrium with the oxide. Thereafter, the oxide film was removed and a tensile test was performed between 4.2 and 20K. As the oxygen concentration is increased by increasing the doping temperature (873, 973 and 1073K), the elongation to fracture at 4.2K decreased. Specimens, which are doped with oxygen at 973 and 1073K and fracture at 4.2K along grain boundaries without any appreciable elongation, are completely ductile at 20K. If well-decarburized and not doped with oxygen, a commercial high purity iron (the Johnson-Matthey iron) is more susceptible to IGF than high purity iron. The results show that oxygen segregated at grain boundries weakens the grain boundary cohesion of iron to some extent, but that the effect is not so large as considered before. (25 refs.)

68627 Brittleness of Sendust. S.Hanada, S.Watanabe, T.Sato, S.Ono, O.Izumi (Res. Inst. for Iron, Steel & Other Metals, Tohoku Univ., Sendai, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.336-42 (April 1983). In Japanese.
The brittleness of Sendust with the nominal composition of 9.6% silicon, 5.4% aluminum and the balance of iron has been studied experimentally. By high thermal stress due to temperature gradient in the crystal, cleavage cracks along {001} plane or grain boundary cracks are easily introduced during either solidification after casting or subsequent heat treatments. The {001} cleavage cracks are also formed under applied external stress. Fracture stress of hot rolled Sendust examined by bending tests is higher than that of cast one, indicating the removal of internal defects by hot rolling. The single crystal which was prepared by zone-melting, and therefore, less-stressed thermally can be bent plastically even at room temperature, showing a lack of internal defects acting as the origin of cracking. (5 refs.)

68628 The influences of heat-treatment and cold-work on the low temperature hydrogen embrittlement of austenitic stainless steels. M.Kuribayashi, H.Okabayashi (Res. Inst., Ishikawajima-Harima Heavy Industries Co. Ltd., Yokohama, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.365-72 (April 1983). In Japanese.
The influences of heat-treatment and cold-work on the mechanical properties at low temperature of cathodically-hydrogen-charged austenitic stainless steels are investigated. Austenitic stainless steels heat-treated at 1073K exhibit hydrogen embrittlement on a low temperature testing at 77K. The susceptibility to low temperature hydrogen embrittlement (LTHE) of seven kinds of austenitic stainless steels, heat treated at 0173K for 86.4 ks, can be arranged in the following order; SUS304>316>321>310=347>304L=316L. In the case of SUS304, the materials which were heat-treated at 923-1223K, especially at 1073-1173K, exhibit the LTHE. Cold-work shows a harmful effect on the LTHE. (11 refs.)

68629 The Bainite transformation and fracture mode of Fe-C-Mn high strength steel containing high carbon. Jin Tae Song (Dept. of Materials Engng., Hanyang Univ., Seoul, Korea).
J. Korean Inst. Met., vol.20, no.12, p.1062-9 (Dec. 1982). In Korean.
The morphology and fracture mode of the bainite in a Fe-C-Mn high-strength hypereutectoid steel have been examined by means of optical, scanning electron, and transmission electron microscopy, and also the isothermal decomposition of a Fe-1.35% C-2.06% Mn austenite has been investigated in connection with its hardenability. It is shown that the bainite transformation has taken place both by columnar type growth along grain boundaries forming the grain boundary allotriomorphic form and by nodular type growing into the grain, which are distinctly different from the usual bainite appearances. It is also shown that there may be no transition temperature from upper to lower bainite. It is found by the fractographic study that the fracture is predominantly transcrystalline showing cleavage facet. But, there are the small amount of quasi-cleavage and dimple fractures in bainite phases transformed at lower temperature, and also the fracture unit in them is relatively finer. It seems the inferiority of fracture ductility in this steel is attributed to proeutectoid cementites along austenite boundaries or a Widmanstatten type of cementites grown into bainite grains, which can be removed by the proper heat treatment alternative, rather than to its peculiar bainite. (17 refs.)

68630 About embrittlement process in amorphous metals. Chr.Janot, B.George, G.Marchal, P.Delcroix (Lab. de Phys. du Solide, Univ. de Nancy I. Vandoeuvre-les-Nancy, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.209-13 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Ribbons of metallic glasses whose general composition is $M_{80}X_{20}$ (M=Fe, Cr; X=P, C, Si) become brittle upon thermal annealing far below their crystallization temperature ($T_{EM}\simeq T_{CR/2}$). Bending tests in correlation with Mossbauer spectroscopy data (transmission and backscattering geometries) along with positron lifetime measurements show that this embrittlement could be due to the onset of precrystalline or microcrystalline layers each side of the ribbon. (13 refs.)

68631 Viscous failure of glass at high shear rates. J.H.Simmons, R.K.Mohr, C.J.Montrose (Dept. of Phys., Catholic Univ. of America, Washington, DC, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.439-42 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The viscosity of a soda-lime-silica glass was measured at high shear rates and 'pseudo-plastic' behavior was observed. An analysis of the data shows that the increased flow results from structural rearrangements in the glass. A characteristic failure stress is discovered and is related to a transition from ductile to brittle behavior. (2 refs.)

68632 Strength of chalcogenide glasses of the system Se-Ge-As. G.H.Frischat, B.-D.Michels (Arbeitsgruppe Glas, Tech. Univ. Clausthal, Clausthal, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.581-3 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Macro- and microstrength (four point bending strength σ_B, critical stress intensity factor K_{IC}, and load-independent microhardness L_2VH) were determined on different glasses of the chalcogenide system Se-Ge-As. $\sigma_{B3/2}$ and L_2VH values between 700 and 1400 Nmm^{-2}. The values on chalcogenide glasses are discussed with respect to other glass composition. (11 refs.)

68633 Tensile strength characteristics of 'perfect' silica fibers. C.R.Kurkjian, J.T.Krause (Bell Labs., Murray Hill, NJ, USA), U.C.Paek.
J. Phys. Colloq. (France), vol.43, no.C-9, p.585-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Interactions at the tip of macroscopic cracks in silica glass as they are influenced by time, temperature, stress and water concentration have been studied for some time. On the other hand, the same interactions when they occur at the 'perfect' surface of a virgin silica fiber are almost unstudied. The availability of precision-drawn silica fibers for lightguides has afforded an opportunity for such studies. Recent results have shown that such fibers are in fact flaw-free and that the statistical nature of their apparent strength is due solely to diameter fluctuations. It has been found that there are substantial differences between the mechanical behavior of these 'perfect' surfaces and that of normal 'flawed' surfaces. (9 refs.)

68634 Strength of optical fibres under combined stresses and aging in various environments. A.Zaganiaris, J.J.Balay, A.Guillerme (CNST, Lannion, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.587-90 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
This paper is an overview of the various parameters determining the mechanical behaviour of the optical fibres. Some recent results are presented and discussed in the light of fracture mechanics, Weibull statistics and surface fractographic analysis. Lifetime evaluations under various service environments are presented as a function of the mechanical properties of the fibre. The combined stress configuration analysis is tied to the realistic assumption that the fibres will be subjected in operation conditions to a complex stress field. The results together with those of short and long term stability of fusion splices, are particularly important to engineering field installations. (3 refs.)

68635 Dynamic fracture in borosilicate glasses. J.Cagnoux.
J. Phys. Colloq. (France), vol.43, no.C-9, p.591-4 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
Impact methods are used to create dynamic fracture in borosilicate glass. Piezoresistive gages located in a buffer-material are used to determine the time resolved stress during fracture. No fracture is produced by a tensile stress smaller than 9 kbar, in absolute value, for a duration pulse of 1.7 μs. Up to this threshold, for a short duration pulse the stress to cause fracture is higher than for a long duration pulse. Results are in accordance with the nucleation and growth of spall damage. It is assumed that the nucleation stage is an intergranular decohesion between boundaries of vitreous microphases. (12 refs.)

68636 Plasticity and fracture of inorganic glasses at high speed grinding. M.G.Schinker, W.Doll (Fraunhofer-Inst. fur Werkstoffmech., Freiburg, Germany).
J. Phys. Colloq. (France), vol.43, no.C-9, p.603-6 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
For different optical glasses the high-speed grinding process has been simulated by scratching the surfaces with a single point diamond tool in the speed range up to 100 m/s and the plasticity and fracture behavior of the glasses with single scratched grooves have been investigated by direct microscopic observation and by subsequent SEM-analysis. The generation of median cracks perpendicular to the surface is found to be restricted to low speeds in the range of metres per second, dependent on the type of glass. At higher speeds plastic grooving takes place and indication to very high temperatures are observed in the grooves. The plastic behavior of the glasses shows a glass and speed dependent change which has been associated to a change from quasi-isothermal yielding to adiabatic flow at higher temperatures in the scratched zone. (7 refs.)

68637 Dynamic fatigue of sodium-silicate glasses with high water content. S.Ito, M.Tomozawa (Rensselaer Polytech. Inst., Troy, NY, USA).
J. Phys. Colloq. (France), vol.43, no.C-9, p.611-14 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The stress-rate dependency of the mechanical strength of sodium silicate glass with high water content (up to ~25% by weight) was investigated. The glasses were prepared by drying commercial sodium silicate solution in an oven or an autoclave. The mechanical strength of the glasses was measured by a four point bending method at various stress rates. These glasses showed a strong stress rate dependency even in dried paraffin oil and the dependency increased with increasing water content; the value of n, a measure of the stress rate dependency, was approximately 5 for glasses with ~25 wt.% water. At the same time Young's modulus decreased with increasing water content. It is suggested that stress-induced motion of water is responsible for the increased stress rate dependency. In addition, the apparent value of Young's modulus decreased with decreasing stress rate. This phenomenon was explained in terms of the visco-elastic property of the glasses. (18 refs.)

68638 Thermal stresses in glass panels with multiple hot zones. S.T.Gulati, D.A.Nolan (Corning Glass Works, Corning, NY, USA), C.Janssen.
J. Phys. Colloq. (France), vol.43, no.C-9, p.615-18 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The interaction of two unequal circular hot zones on thermal stresses in the remaining cold region of rectangular glass panels is examined via finite element analysis. The results are then compared with those given by an approximate analytical solution. The FEM and analytical solutions agree to within 15%. The simplicity of the analytical solution, however, makes it a useful screening tool during the design phase of nonuniformly heated glass panels. The solution is also useful for assessing the probability of thermal fracture by comparing stresses in the region between the hot zones with those at the edge of the panel. (3 refs.)

68639 Concentration fluctuations as sources of internal stresses in metallic glasses. A.R.Yavari (Ecole Nat. Superieure D'Electrochimie et d'Electrometall., Domaine Univ., Saint Martin d'Heres, France).
J. Phys. Colloq. (France), vol.43, no.C-9, p.619-22 (Dec. 1982). [received: April 1983] (Physics of Non Crystalline Solids. Proceedings of the 5th International Conference, Montpellier, France, 5-9 July 1982).
The author shows that concentration fluctuations frozen in at T_g, result in microscopic regions of large positive or negative internal stresses in the asquenched glass. The negative and positive stresses correspond to zones rich in free-volume and anti-free volume respectively. The effect is particularly large in ferromagnetic Invar-type alloys. It is suggested that internal stresses due to concentration fluctuations can result in the production of quasi-dislocations detected by the field-dependence of the approach to magnetic saturation and density fluctuations detected in neutron small-angle scattering measurements. A connection with embrittlement of annealed specimens is also indicated. (18 refs.)

68640 Low temperature fatigue fracture of metals and alloys. B.I.Verkin, N.M.Grinberg, V.A.Serdyuk, L.F.Yakovenko (Phys.-Tech. Inst. of Low Temperatures, Acad. of Sci., Kharkov, Ukrainian SSR).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.145-687 (April 1983).
Using the data available in the literature and the present authors' previous results the present-day studies of low temperature fatigue fraction of metals and alloys are reviewed in terms of the physics of metals. The effect of low temperatures on the fatigue life and fatigue limit of different crystal lattice types of metals and alloys is considered. The correlation between an increase in fatigue life and a reduction in temperature is analysed and certain exceptions to this correlation are pointed out. The problem of both the simultaneous influence of temperature and environment and the separate effects of each of these factors on cyclic fatigue life is discussed. It has been found that a superconducting transition affects the cyclic fatigue life of certain superconductors and that the effect of the superconducting state on fatigue life is ambiguous; this is accounted for by the varying plasticity of the superconductor. The experimental data on dislocation structure and fatigue crack nucleation at temperatures down to 4.2K are discussed. Particular attention is given to the effect of low temperatures on the rate of fatigue crack growth and the threshold points of this stage. (98 refs.)

68641 On the dependence of fracture toughness on metallurgical factors. N.Tsangarakis (Army Materials & Mechanics Res. Center, Watertown, MA, USA).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.269-76 (April 1983).
The impact of metallurgical fators, such as microstructure, impurities and grain size on the value of fracture toughness, is discussed. Some evidence exists for the beneficial effects of retained austenite, low impurity content and small grain size in improving the fracture toughness of steels. In materials with a Widmanstatten structure, increasing the grain size has a beneficial effect on fracture toughness. If the chemistry of an alloy is known, it is possible to design heat treatments so as to improve effectively the resistance to fracture of the said alloy. Research on the fracture behavior of metallic materials should be accompanied by a complete metallographic examination and correlation of metallurgical factors with the material behavior under the condition of a propagating crack. (29 refs.)

68642 Analytical description of ageing of polyamide 6 subjected to fatigue failure. M.Nowak (Politech. Wroclawska, Wroclaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.3, p.435-54 (1981). In Polish.
The variation of fatigue behavior of polyamide 6 (PA 6) during ten years of ageing is presented. The hypothesis of the ageing process of polymers, based on experimental results and general physico-chemical properties of polymers has been proposed in the following form: the fatigue limit of thermoplastics Z aged in laboratory environment conditions decreases in agreement with a Gaussian distribution (with parameters) and a general empirical equation. (44 refs.)

68643 Theoretical fatigue life of helically stranded optical fibres. M.Fox (BICC Res. & Engng. Ltd., London, England).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.253-60 (May 1983).
The design of optical fibre cables currently preferred by BICC ordinarily produces little or no tension or torsion in the fibres. Bending them into helical form, however, causes a permanent stress which could give rise to static fatigue. In a recent paper, the probability that a bent fibre will fail owing to static fatigue was calculated. The calculation is extended in the present paper to take account of proof-testing. Assuming reasonable values for the parameters, it appears that a fibre of 125 μm diameter, proof-tested at 0.5% strain and subsequently bent to a radius of not less than 25 mm, would certainly survive for 40 years. (16 refs.)

68644 Low-temperature studies of laminates. I. Effect of low temperatures on the mechanical properties. B.Biernacki (Inst. Okretowy, Politech. Gdanska, Gdansk, Poland).
Polim. Tworzywa Wielkoczasteczkowe (Poland), vol.27, no.4, p.164-7 (April 1982). In Polish. [received: March 1983]
The studies of the strength properties of laminates prepared from home-made semiproducts have shown their good resistance to the action of low temperatures. A negative effect of thermal shocks on the material structure and mechanical characteristics has been observed. This effect depends primarily on the temperature difference between the cooling medium and the material being cooled. The highest resistance to the action of thermal shocks had laminates based on Polimal 139 polyester resin. (4 refs.)

68645 Fracture surfaces and mechanical properties of tungsten heavy metals. H.Danninger, M.Schreiner, G.Jangg, B.Lux (Inst. fur Chem. Technol. Anorganischer Stoffe, Tech. Univ. Wien, Wien, Austria).
Prakt. Metallogr. (Germany), vol.20, no.2, p.64-73 (Feb. 1983). In English, German.
A clear relation can be stated between the mechanical properties and the appearance of the fracture surfaces of W heavy metals sintered differently. Those alloys prepared from green compacts that were not pre-reduced before sintering are extremely brittle, and at the fracture surfaces only intergranular fracture can be observed, which effects are apparently caused by oxygen contamination of the phase boundaries. The fracture surfaces of pre-reduced and therefore ductile samples, in contrast, exhibit a large amount of transgranular fracture as the crack runs through the sample without being deflected by phase boundaries. The microcracks formed at the W-W grain boundaries at high degrees of deformation are stopped and separated by the binder and cannot propagate along the phase boundaries. The binder is dispersion hardened by oxide particles and since it absorbs the entire deformation energy naturally both strength and ductility are lowered. (9 refs.)

68646 Strain localization during fatigue of precipitation-hardened aluminium alloys. Jia-Kuen Lee, C.Laird (Dept. of Materials Sci. & Engng., Univ. of Pennsylvania, Philadelphia, PA, USA).
Philos. Mag. A (GB), vol.47, no.4, p.579-97 (April 1983).
Fatigue tests of Al-3.8 wt.% Cu containing θ'' precipitates have been carried out at two plastic strain amplitudes, 9.0×10^{-4} and $9.2 \times^{-5}$ corresponding to the high- and low-strain regions of the plateau in the cyclic stress-strain curve. The tests were interrupted at points in life both before and after the occurrence of peak hardening. During interruptions the specimens were repolished and retested for a quarter cycle in tension. The slip offsets thus produced were measured by interferometry and the strains revealed were compared with the overall value imposed during the quarter cycle of straining. Persistent slip bands (PSBs) start to form just before the hardening peak and the strain was observed to localize within the PSBs. With more cycles, the localization intensifies both in existing micro-PSBs and by the creation of new micro-PSBs. After the peak stress is attained, zero or minimal nucleation of micro-PSBs was observed. Nearly all of the plastic strain after the peak is localized in the PSBs and is manifested as surface slip steps. The average value of localized strain ranges from 0.3 to 0.6, two orders of magnitude higher than that observed in copper, and the volume fraction of PSBs was observed to be extremely low throughout the plateau. (17 refs.)

68647 Arsenic and platinum deposition during cathodic hydrogenation. M.B.Lewis, K.Farrell (Metals & Ceramics Div., Oak Ridge Nat. Lab., Oak Ridge, TN, USA).
Scr. Metall. (USA), vol.17, no.3, p.365-9 (March 1983).
Describes the finding of significant accumulation of promoters (or poisons) at the cathode during cathodic hydrogenation. Aggregation of supposedly inert platinum anode material also occurred and was enhanced by the presence of the promoter. It is suggested that these deposits should be considered in hydrogen embrittlement tests made under dynamic cathodic electrolysis. (9 refs.)

68648 Precipitation induced embrittlement after thermal exposure of high-manganese, austenitic retaining-ring steels. J.Albrecht (Brown Boveri Res. Center, Baden, Switzerland).

Scr. Metall. (USA), vol.17, no.3, p.371-4 (March 1983).

An investigation was carried out in order to study the response of two steels, X55MnCr18 (18%Mn, 5%Cr and 0.5%C) and X5CrMn1818 (18%Mn, 18%Cr, low C, N alloyed) to thermal exposure. The results show that both steels react to high temperature exposure with a loss of fracture toughness. This loss is due to precipitation of grain boundary carbides—known as sensitization—and is quite common in carbon-alloyed chromium steels. (5 refs.)

68649 Crack-tip heating in steel during cyclic loading. P.J.Loos (Hughes Tool Co., Houston, TX, USA), F.R.Brotzen.

Scr. Metall. (USA), vol.17, no.3, p.389-92 (March 1983).

Concerns the experimental determination of crack-tip temperature by infrared techniques during low-frequency fatigue loading. Specimens were machined from a bar of hot-rolled AISI 4135 steel. Load and displacement were recorded while the crack-tip temperature rise was noted. The results obtained indicate clearly that infrared techniques can be used advantageously in the study of fracture of ductile materials. (4 refs.)

68650 On the existence of hydrostatic stress fields for mode II hydrogen embrittlement. R.Magdowski, W.W.Gerberich (Dept. of Chem. Engng., Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).

Scr. Metall. (USA), vol.17, no.3, p.421-2 (March 1983).

In a recent paper on hydrogen embrittlement in mode II loading (see Br. Corros. J., vol.17, p.18, 1982) R.F. McGuinn and M. Aballe reported about static mode II testing of externally charged cold drawn bars. Their results showed hydrogen embrittlement which led the authors to the conclusion that, in contradiction to former understanding, a significant bulk hydrostatic stress is not a necessary condition for hydrogen cracking. The present authors wish to point out that because these investigators only used the pure elastic solutions their work may contain an interpretative error. (6 refs.)

68651 Influence of the breakdown mechanism on the behavior of lead-antimony alloys with an alternating load. T.F.Elsukova, N.I.Afanas'ev, A.N.Makaeva (V.D. Kuznetsov Physicotech. Inst., Tomsk State Univ., Tomsk, USSR).

Sov. Phys. J. (USA), vol.25, no.8, p.733-7 (Aug. 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.8, p.61-4 (Aug. 1982). [received: April 1983]

For the example of Pb-Sb alloys, the influence of aging is investigated, as a function of its mechanism, on the resistance to fatigue deformation, leading to rupture along the grain boundaries. It is shown that continuous breakdown increases the cyclic life, whereas discontinuous breakdown considerably reduces it. The most effective means of suppressing discontinuous breakdown, and hence increasing the resistance to grain-boundary fatigue breakdown, is by doping with elements which reduce the mobility of the grain boundaries, such as tellurium in lead. Doping with elements that facilitate discontinuous breakdown (such as As in Pb-Sb) leads to significant reduction in the fatigue resistance. (10 refs.)

68652 The influence of structure parameters on strength and fracture toughness of brittle covalent crystals and corresponding sintered materials. V.I.Trefilov (Inst. for Problems of Material Sci., Kiev, Ukrainian SSR), M.M.Ristic, Ju.V.Milman, D.P.Uskokovic, I.V.Cridneva.

Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.497-504

It was the theoretically and experimentally analyzed structure sensitivity of the mechanical properties of covalent crystals and some other sintered materials that enables a significant increase in material strength and the choice of an optimal method for the synthesis of corresponding complex systems. (12 refs.)

68653 The influence of titanium carbide and bonding phase composition on the properties of titanium carbide-steel cermets. S.S.Kiparisov, Z.D.Khochol-ava, V.K.Narva (Inst. of Metall., Tbilisi, Georgian SSR).

Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.511-18

Conditions of obtaining titanium carbide steel Kh12M (30 and 50 wt.% TiC) alloys at different composition of titanium carbide (C_{bond} content-14.4 to 19.1 wt.%) have been investigated. Optimal regimes of pressing, sintering and heat treatment of sintered materials of TiC-steel (Kh12M, Kh4H2M8) with different content of carbon (0.5-1.5%) are recommended. It was established that at sintering of alloys being deficient in carbon, carburisation of TiC takes place causing decarburization of steel bonding phase. This complicates achieving optimum strength properties also after heat treatment. Hardness after sintering and heat treatment, compressive and bending strength and durability decrease with increasing carbon deficiency in titanium carbide. The decrease of carbon content in composition of steels X12M and X4H2M8 causes some lowering of hardness of sintered and thermally treated material. (4 refs.)

68654 Effects of cold rolling and annealing on the mechanical properties of 90W-7Ni-3Fe heavy alloys. M.Yodogawa (Res. Lab. of Precision Machinery & Electronics, Tokyo Inst. of Technol., Yokohama, Japan).

Sintering - Theory and Practice. Proceedings of the 5th International Round Table Conference on Sintering, Portoroz, Yugoslavia, 7-10 Sept. 1981 (Amsterdam, Netherlands: Elsevier 1982), p.519-25

The relationship between ultimate tensile strength (UTS), elongation and the microstructure of cold rolled and annealed 90W-7Ni-3Fe heavy alloys was investigated using tensile tests, hardness tests, microscopy and fractography. Due to strain hardening, the UTS of the cold rolled unannealed alloy increased from 900 MN/m^2 for the unrolled alloy to 1800 MN/m^2 for alloy cold rolled 90% and the elongation drops drastically. By annealing at temperatures up to 700°C a further increase in UTS caused by segregation of tungsten in the matrix phase and by strain aging of the tungsten particles was observed. With higher annealing temperatures recrystallization of the matrix decreased the strength; this was accompanied by increase in elongation. Above 1000°C, recrystallization of the deformed tungsten particles started, causing a remarkable change in the fracture mode of the alloy: the fracture appearance of the matrix phase was always ductile whereas the tungsten particles showed cleavage fracture mode below 1000°C and grain boundary fracture in the recrystallized state above 1000°C. (12 refs.)

68655 Mechanical behaviour of eutectic superalloys. M.McLean (Div. of Materials Applications, NPL, Teddington, England).

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.1-19

The mechanical properties of in-situ composites intended for use as gas turbine materials are reviewed. Particular emphasis is placed on the current understanding of strengthening and fracture mechanisms of these materials. The need to modify current methods of data representation, that have been developed for more conventional materials, in order to improve property extrapolation and design procedures are highlighted. (26 refs.)

68656 The low cycle fatigue behavior of three advanced nickel-base eutectic composites. T.Ishii, D.J.Duquette, N.S.Stoloff (Materials Engng. Dept., Rensselaer Polytech. Inst., Troy, NY, USA).

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.59-68

The low cycle fatigue behavior at 25°C and 825°C of three advanced nickel-base eutectics is described. Fatigue lives are shown to obey a linear relation with plastic strain range (Coffin-Manson relation) but lives are much lower than are observed for conventional metals and alloys. Cyclic hardening and softening were observed in each alloy at 25°C; however, this behavior differs from the classical saturation behavior observed with isotropic materials. (8 refs.)

68657 Fatigue crack growth in Co and Ni base directionally solidified eutectic composites. C.Hoffmann, P.Bhowal, A.J.McEvily (Metall. Dept., Univ. of Connecticut, Storrs, CT, USA).

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.69-83

A study of fatigue crack growth behavior in four directionally solidified eutectic composites has been carried out in air at room temperature and at 870°C (1600°F). The alloys investigated included two cobalt-base alloys, CoTaC and CoTaC+Cr, and two nickel base alloys, γ'-Mo and γ/γ'-δ. Fatigue crack growth was studied in directions parallel and perpendicular to the solidification direction. It was found that the addition of chromium to the CoTaC alloy strengthened the interface and promoted trans-fiber crack growth. In addition, the effect of interlamellar spacing on the rate of fatigue crack growth was examined for the γ/γ'-δ alloy. A reduction in interlamellar spacing reduced the crack growth rate. (14 refs.)

68658 The role of solidification rate on fiber distribution and mechanical properties of a directionally solidified nickel base-TaC eutectic. J.L.Water (General Electric Corp. Res. & Dev., Schenectady, NY, USA).

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.85-102

A nickel base-TaC eutectic alloy consisting of 53 wt.% Ni, 11 W, 3 Re, 5 Co, 3 Mo, 2 Al, 21.67 Ta and 1.33 C was directionally solidified at rates from 0.32 to 3.8 cm/hr. Samples were taken from the regions of aligned TaC fibers and tested in tension at 1000°C and in stress-rupture. The fiber density increased from 1×10^6 fibers/cm^2 at 0.32 cm/hr to 27×10^6 fibers/cm^2 at 3.8 cm/hr. The stress-rupture life at 927°C and 275.6 MPa ranged from 4 hrs for samples solidified at 0.32 cm/hr to 4187 hrs for the sample solidified at 2.54 cm/hr at which time the test was terminated. Examination, by transmission electron microscopy, of the samples tested at 1000°C in tension, to just the beginning of fiber breakage, revealed a change in the mode of deformation of the nickel-base alloy matrix with increasing fiber density. It was also seen that the TaC fibers deformed by two mechanisms; by slip and by the formation of stacking faults. (16 refs.)

68659 Off-axis mechanical properties of a cellular Al-Al_3Ni directionally solidified eutectic. D.W.Hetzner (Timken Co., Canton, OH, USA), B.F.Oliver, W.T.Becker.

In Situ Composites IV. Proceedings of the Fourth Conference on In Situ Composites (CISC IV), Boston, MA, USA, 16-19 Nov. 1981 (North-Holland: New York, USA 1982), p.329-40

Ingots having a cross-sectional area of 1.27 cm×10.8 cm were directionally solidified for testing off-axis tensile properties. To avoid macroscopic banding due to inductive melting and thermal convection, growth rates of 2.2 cm/min were required. The resulting solidification structures were cellular. The macroscopic tensile behavior of the eutectic alloy was similar to that observed for mechanically formed fiber-reinforced composite materials; in particular, three distinct modes of fracture occurred. In Region I, where the angle (ϕ) between the growth direction and the tensile axis was small, the tensile strength of the composite was inversely proportional to $\cos^2\phi$. In region II ($20°\leq\phi\leq55°$) and region III ($60°\leq\phi\leq90°$), the tensile strength of the composite was inversely proportional to $\sin\phi$, $\cos\phi$, and $\sin^2\phi$, respectively. For all regions, failure was initiated by the fracture of large Al_3Ni intercellular blades. (13 refs.)

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems ....See Entry 64588

The effect of composition and radiation on the fracture of a nuclear waste glass ....See Entry 65338

The susceptibility of SA-508-II and SA-533B to reheat cracking-evaluation of empirical and theoretical predictive methods ....See Entry 65358

Axisymmetric problem of a flat interface annular crack between an elastic layer and a half-space ....See Entry 66509

Internal energy dissipation in metals subjected to cyclic stresses with varying amplitudes ....See Entry 66513

Nature of substructural hardening ....See Entry 66526

Transient response of a central crack to a tensile pulse ....See Entry 66536

Diffusive relaxation of stress concentrations at grain boundary cavities in elevated temperature creep ....See Entry 67100

Tetragonal distortion and drift flow of solute atoms near a crack tip ....See Entry 67104

Semiempirical, quantum mechanical calculation of hydrogen embrittlement in metals ....See Entry 67105

The surface energy of zinc ....See Entry 67339

Growth and some properties of single crystals of $CuAlSe_2$ and $CuGaSe_2$ ....See Entry 68433

Growth and thermal stability of γ/γ'-α eutectic composite ....See Entry 68477

Sintering of partially stabilized zirconia ....See Entry 68491

Sintering of calciumphosphate ceramics for biomedical purposes ....See Entry 68492

Section of the phase diagram of the In_2Te_3-Fe system in the vicinity of In_2Te_3 and thermodynamic investigation of nonionized impurity atoms in crystals with stoichiometric vacancies ....See Entry 68519

Stress-induced transformations in composite zirconia ceramics ....See Entry 68539

Thermal effect of nitrogen implantation on high carbon steels ....See Entry 68549

The work-hardening behaviour of hydrogen-charged high purity iron single crystals at temperatures between 296 and 200K ....See Entry 68562

On the influence of impurity additions and quenching temperature on the course of the microhardness (HV) during a two-step ageing treatment of an Al-2.0 at.% Zn-1.3 at.% Mg alloy .... See Entry 68567

Necking and deformation behavior of locally annealed aluminum sheets in simple tension .... See Entry 68590

Transverse mechanical behavior of high-strength monocarbide eutectics .... See Entry 68609

Off-axis tensile properties of γ/γ'-αMo DS eutectic .... See Entry 68611

The influence of hardness on the resistance to wear by paper .... See Entry 68664

Structural characterization of laser-processed molybdenum steel .... See Entry 68694

81.40P Friction, lubrication, and wear

(see also 62.20P Tribology)

68660 Wear-resistant cobalt-base alloys. K.C.Antony (Cabot Corp., Kokomo, IN, USA).
J. Met. (USA), vol.35, no.2, p.52-60 (Feb. 1983).
Microstructurally, wear-resistant cobalt-base alloys consist of hard particles (Cr_7C_3) dispersed in cobalt-rich (Co>50%) solid solution matrix alloys (generally Co-Cr-W/Mo). Recent investigations have shown that the adhesive and cavitation-erosion wear characteristics of these alloys are determined by the composition of the matrix alloy and are influenced to a large extent by a strain-induce FCC→HCP allotropic transformation in the matrix alloy. It has been shown that the cobalt content in the matrix alloy can be decreased to approximately 30% without significantly degrading relevant wear or corrosion properties. Toughness and abrasive wear resistance on the other hand, are determined primarily by carbide volume fraction and morphology. (12 refs.)

68661 A study of cavitation erosion of cast iron. T.Okada, Y.Iwai (Dept. of Mech. Engng., Fukui Univ., Fukui, Japan), A.Yamamoto.
Wear (Switzerland), vol.84, no.3, p.297-312 (1 Feb. 1983).
Cavitation erosion tests were carried out in ion-exchanged water using four cast irons (gray or spheroidal graphite) together with carbon steels with the same matrix as the cast irons. The erosion mechanism of the cast irons is explained through the growth of eroded cracks which depends on both the notch action of graphite and the notch sensitivity of the matrix. The erosion resistances of the cast irons and of the carbon steels were compared. A linear relation was obtained from the logarithmic curve between the reciprocal of the maximum mass loss rate and $H_V^2/E\beta_g$ (where H_V is the Vickers microhardness, E is the elastic modulus and β_g is the fatigue strength reduction factor for cast iron). It is thus concluded that the cavitation erosion resistance of cast iron is less by a factor of $(1/\beta_g)^{1.7}$ than that of carbon steel of the same hardness as the cast iron matrix. (12 refs.)

68662 The effect of carbide volume fraction on the low stress abrasion resistance of high Cr-Mo white cast irons. J.K.Fulcher, T.H.Kosel, N.F.Fiore (Dept. of Metall. Engng. & Materials Sci., Univ. of Notre Dame, Notre Dame, IN, USA).
Wear (Switzerland), vol.84, no.3, p.313-25 (1 Feb. 1983).
High chromium white cast irons display a number of advantages in abrasive wear applications. Their composition may be adjusted so that they contain moderate amounts of chromium yet solidify to produce massive chromium-rich carbides in an austenitic matrix of sufficient hardenability to be transformed to martensite with relatively simple heat treatment. The role of carbide volume fraction (CVF) in developing abrasion resistance was investigated using a series of alloys with varying CVF but with constant matrix and carbide compositions. The low stress abrasion resistance of the alloys against quartz and Al_2O_3 was measured with a dry abrasive rubber wheel abrasion test. The abrasion resistance passed through a maximum at an intermediate CVF, near the eutectic composition, for the softer quartz, while the abrasion resistance increased monotonically with the CVF for tests against the harder Al_2O_3. Scanning electron microscopy showed that for quartz abrasion the reversal in the trend of wear versus CVF which occurred at the eutectic composition was caused by spalling and pitting of the massive primary M_7C_3 carbides in the hypereutectic alloys. This phenomenon did not occur in the Al_2O_3 abrasive tests, in which a monotonic increase in wear resistance with CVF was observed. (11 refs.)

68663 A study of abrasive wear mechanisms in cobalt-base alloys. H.R.Shetty, T.H.Kosel, N.F.Fiore (Dept. of Metall. Engng. & Materials Sci., Univ. of Notre Dame, Notre Dame, IN, USA).
Wear (Switzerland), vol.84, no.3, p.327-43 (1 Feb. 1983).
Single-point scratch tests were used to investigate material removal mechanisms in two cobalt-base powder metallurgy alloys 6 and 19. Each alloy was produced with fine, medium and coarse chromium-rich M_7C_3 carbides in a cobalt-rich FCC matrix phase. The scratch test study was designed to simulate low stress abrasion conditions by using single quartz abrasive particles as scratch tools, and the results are compared with those from scratches made using regularly shaped diamond tools. Single- and multiple-pass scratches were made with several different loads using Vickers diamond pyramids and single quartz abrasive particles on metallographically prepared surfaces. Single-pass scratches were also made on preworn surfaces by using a Vickers diamond. Single-pass diamond scratches exhibited ploughing and extensive coarse slip bands in the matrix phase of metallographic specimens. Evidence of carbide deformation and of slip band cracking of the matrix material was observed also. Coarse slip bands were not observed on preworn surfaces. Scratch tests with quartz particles exhibited slip band cracking, smeared matrix material over the carbides and cracking and pulling out of carbides similar to observations with diamond tools. However, extensive ploughing and shear lip formation were not observed in quartz scratches. (13 refs.)

68664 The influence of hardness on the resistance to wear by paper. R.G.Bayer (IBM Corp., Endicott, NY, USA).
Wear (Switzerland), vol.84, no.3, p.345-51 (1 Feb. 1983).
Abrasive wear data for a wide range of materials sliding against paper are compared to establish a general dependence on hardness of the abraded material. Three regions for the hardness dependence are identified. In all three regions, the wear rate depends on $(\text{hardness})^{-n}$. In the region for which the hardness of the abrasive is larger than that of the abraded material, $n \approx 1$; in the region where the hardnesses are similar, $n \approx 10$; in the region where the abraded material is harder, $n \approx 5$. (11 refs.)

68665 The processes accompanying metal wear in polymer-containing abrasive media. T.V.Dmitriyeva, L.M.Grayevskaya (Inst. of Macromolecular Chem., Acad. of Sci., Kiev, Ukrainian SSR).
Wear (Switzerland), vol.84, no.3, p.353-9 (1 Feb. 1983).
The lapping process was studied. It was found that metal wear is determined by a series of factors: polymer or oligomer quantity in the heterophase system, lapping-in pressure, working time of the polymer-abrasive paste or suspension and the accumulation of particles from the lapped metal. (6 refs.)

68666 Wear of aluminium under dry sliding conditions. R.S.Yaseen, E.S.Dwarakadasa (School of Production Engng. & Metall., Univ. of Technol., Baghdad, Iraq).
Wear (Switzerland), vol.84, no.3, p.375-9 (1 Feb. 1983).
The wear behaviour of pure aluminium exhibits two distinct regions of wear in the low load ranges marked by a sharp transition point. At very low loads wear is apparently controlled by a purely oxidative mechanism, while at moderately high loads it changes to a combined oxidative-cum-metallic type of wear. The transition is marked by a volume wear rate of about 10^{-8} cm^3 cm^{-1} and the load at which this transition takes place is a function of the wear conditions of speed, relative hardness and roughness of the disc surface as well as the ambient conditions of temperature and humidity. The purely severe metallic wear observed by other investigators is considered to occur only under very high bearing loads. (15 refs.)

68667 The erosion rate of reaction-bonded SiC containing various amounts of free silicon. J.L.Routbort, A.P.L.Turner (Materials Sci. & Technol. Div., Argonne Nat. Lab., Argonne, IL, USA).
Wear (Switzerland), vol.84, no.3, p.381-5 (1 Feb. 1983).
Reports the results of erosion studies obtained on two types of reaction-bonded (RB) SiC having different amounts of free silicon. The results confirm the existence of a threshold for erosion and a particle-size-dependent velocity exponent. The steady state erosion rate not only is a sensible function of the amount of free silicon in RB SiC but depends on the microstructure. (8 refs.)

68668 Correlation of erosion with mechanical properties in metals. D.G.Rickerby (Joint Res. Centre, Ispra Establ., Comm. of the European Communities, Ispra, Italy).
Wear (Switzerland), vol.84, no.3, p.393-5 (1 Feb. 1983).
It is shown that there is apparently little to choose between the mechanical energy density and thermal energy density correlations as far as the erosion of pure metals is concerned. Scatter in the former case would undoubtedly be reduced by the use of mechanical properties measured at appropriate dynamic strain rates. A proper comparative test of the predictive capabilities cannot be made for alloys since a similar set of data obtained under constant experimental conditions is not available in the literature. Addition of relatively small amounts of alloying elements, however, can substantially modify the stress-strain curve while leaving the thermal properties virtually unchanged. As the erosion behaviour of alloys typically differs markedly from that of the parent metal, a better correlation with mechanical rather than thermal properties might consequently be expected. (12 refs.)

Characterization by X-ray topography of subsurface deformation in abrasive wear .... See Entry 67334

Possibilities and limitations for the application of CVD-coated cemented carbide tools and steel tools .... See Entry 68452

Depassivation of iron by straining and by abrasion: an a.c. impedance study .... See Entry 68685

Conforma Clad—a new process for customized coatings .... See Entry 68687

Carbide-dispersion carburizing of vanadium steels .... See Entry 68692

Application of in-air PIXE for corrosion-erosion studies of metal surfaces .... See Entry 68822

81.40R Electrical and magnetic properties (related to treatment conditions)

(see also 72.80 Conductivity of specific semiconductors and insulators, 74.70 Superconducting materials, 75.50 Studies of specific magnetic materials)

68669 The effects of calcining and sintering conditions on the permeability and loss of Mn-Zn-Fe ferrite. Mun-Cheol Paek, Ho-Bin Im, Su-Il Pyun.
Trans. Korean Inst. Electr. Eng., vol.32, no.1, p.24-9 (1983). In English.
The effects of calcining and sintering conditions on the initial permeability and loss of $Mn_{0.54}Zn_{0.4}Fe_{0.06}{}^{2+}Fe_2O_4$ were investigated using specimens calcined at 900°-1110°C for 3 hrs in air, and then sintered at 1200-1275°C for 3 hrs in an atmosphere of 5% O_2+95% N_2 gas mixture, followed by cooling in N_2 atmosphere. The composition of specimens was so selected to hold nearly zero-magnetocrystalline anisotropy constant, K_1, and a small value of magnetostriction constant, λ_s, at room temperature. The specimen calcined at 950°-1050°C in air showed the maximum initial permeability, μ_i, regardless of its sintering temperature. At constant calcining temperature of 950-1050°C, permeability increased with sintering temperature up to 1250°C and then remained constant or slightly decreased. The higher the calcining and sintering temperatures, the higher was the value of the loss factor, Q, of ferrite. The variation of initial permeability and loss was discussed in terms of pores for lower calcining and sintering temperatures, and in terms of discontinuous grain growth for higher calcining and sintering temperatures. A schematic contour diagram of initial permeability and μQ product has been constructed, related to calcining and sintering temperatures. (8 refs.)

Proceedings of the Sixth All-Union Conference on the Physics and Physical Metallurgy of Electromechanical Steels and Alloys .... See Entry 64574

Electrical conductivity and morphology of silicon in A-S13 and A-S7G .... See Entry 67557

A study of impurities and traps in liquid phase epitaxial InP in relation to melt prebaking .... See Entry 67813

Influence of repeated heat treatment on critical current density of Nb-50 wt.%Ti alloy superconductors .... See Entry 67871

Muonic method of investigating the magnetic properties of electrical-engineering steels .... See Entry 67951

Electromagnetic losses of thin magnetically soft ferromagnets at prevailed magnetic-reversal frequencies .... See Entry 67959

Influence of cooling rate on the magnetic properties of untextured electrical-engineering steels .... See Entry 67962

New method of reducing the coercive force and electromagnetic losses in (110) [001] crystal of the alloy Fe-3.2% SI .... See Entry 67963

Investigating the regular behavior of the magnetic losses of cold-rolled isotropic electrical-engineering steel with the aim of creating standard samples .... See Entry 67965

Magnetic properties of Ni, Fe and Co thin films with sulfur impurities .... See Entry 67982

Thermostimulated depolarization currents on a dielectric surface .... See Entry 68115

The dielectric breakdown properties, current density-voltage and capacitance-voltage characteristics of ion-beam-synthesized Si_3N_4 layers ... See Entry 68129

Preparation and electrical properties of $La_{2-x}Sr_xNiO_4$ (x=0-1.0) ....See Entry 68466

Changes in dislocation and electronic structure during copper consolidation ....See Entry 68474

Preparation of a Ni-Zn ferrite from a submicronic grain size powder ....See Entry 68484

Compositional dependence of transformation temperatures in ternary TiNiAl and TiNiFe alloys ....See Entry 68541

Properties of polycrystalline indium oxide in the air and in vacuum ....See Entry 68568

Effect of composition on deformability by hot rolling of Sendust and magnetic properties of hot rolled Sendust ....See Entry 68570

Magnetoelastoacoustic method of nondestructive inspection of heat-treatment quality for steels ....See Entry 68743

Alternating magnetization modes in the quality control of hardened and tempered articles from the value of the residual magnetic induction ....See Entry 68745

Passive and enhanced grain boundaries in solar cells by gas immersion laser diffusion ....See Entry 68893

81.40T Optical properties (related to treatment conditions)

(see also 78.20 Optical properties and materials)

Epon 828 epoxy: a new photoelastic-model material ....See Entry 66530

Properties of polycrystalline indium oxide in the air and in vacuum ....See Entry 68568

81.60 CORROSION, OXIDATION AND SURFACE TREATMENTS

68670 Ion polishing with the aid of a planarizing film. L.F.Johnson, K.A.Ingersoll (Bell Labs., Murray Hill, NJ, USA).
Appl. Opt. (USA), vol.22, no.8, p.1165-7 (15 April 1983).
An ion polishing technique employing a planarizing film in conjunction with ion-beam erosion at the planarizing angle was used to remove surface irregularities associated with conventional polishing of optical surfaces. By maintaining a planar surface throughout the erosion process, nonuniform erosion resulting from faceting, redeposition, and ion reflection is eliminated. Smooth surfaces on fused quartz are obtained by erosion of a planarizing film of photoresist at an angle of 60°C. The method is applicable to a wide variety of materials and may be useful for removing the surface roughness limitation on the laser-induced damage threshold of optical surfaces. (23 refs.)

68671 X-ray photoelectron spectroscopy study of hydrogen plasma interactions with a tin oxide surface. J.H.Thomas,II (RCA Labs., David Sarnoff Res. Center, Princeton, NJ, USA).
Appl. Phys. Lett. (USA), vol.42, no.9, p.794-6 (1 May 1983).
Tin oxide thin films were exposed to an RF excited hydrogen plasma (100 mTorr) for various times. The plasma system was operated in a self-biased mode. X-ray photoelectron spectroscopy analysis of vacuum transferred samples shows that SnO_2 is reduced. A thin self-limiting layer of elemental Sn forms on the reduced film to a thickness of ~10 Å. (17 refs.)

68672 Investigation of phosphosilicate glass layers by partial etching. P.Jagodzinski, E.Jagodzinska (Inst. of Electron Technol., Sci. & Production Centre of Semiconductors, Warszawa, Poland).
Electron Technol. (Poland), vol.13, no.1-2, p.19-28 (1980).
The partial etching method as a tool for investigation and examination of phosphosilicate glass (PSG) layers is compared with the routine method of diffusion into a monitoring wafer. The advantages of partial etching method are presented. They include independence of the silicon surface saturation effect, feasibility of determining phosphorus content profile in the glass, and a possibility of investigating complete integrated circuits with the aim of determining the fabrication parameters and of diagnostics. PSG etching rate versus composition curves have been determined and verified for the cases of P-etch and 100:1 H_2O:HF solution. (6 refs.)

68673 Crystallographic anisotropies in electrochemical etching of Pt. R.Caracciolo, L.D.Schmidt (Dept. of Chem. Engng. & Materials Sci., Univ. of Minnesota, Minneapolis, MN, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.603-7 (March 1983).
Single crystal microspheres of Pt are examined by scanning electron microscopy following electrochemical and chemical etching in chloride and cyanide solutions. In all cases, a single major crystal plane is formed which is not the close packed (111) plane. Rates of dissolution and facet formation also vary among planes and with etching conditions. The largest anisotropy occurs with aqua regia where initial attack is exclusively near (210) but only (110) facets are formed. The (111) and (100) planes are attacked in aqua regia only from their edges, but eventually these orientations are transformed completely into (110) facets. Electrochemical chloride etching with a-c potentials produces large smooth planes near (100), and the (111) plane is attacked readily to form (100) facets. Electrochemical cyanide etching produces the most rapid attack of the (111) orientation to produce facets of (110). Possible mechanisms for these processes and implications for preparation of Pt electrodes are discussed. (19 refs.)

68674 Some illumination on the mechanism of SiO_2 etching in HF solutions. H.Nielsen, D.Hackleman (Hewlett-Packard Co., Corvallis, OR, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.708-12 (March 1983).
The etching of SiO_2 in aqueous buffered HF solutions can be impeded or stopped through the application of an electric field. In CMOS fabrication, very low levels of light can cause the effect. Parallel reaction paths are proposed for the dissolution process, coupled with the electric field's ability to stop or redirect the reaction at an intermediate step. (6 refs.)

68675 Phenomenological model for silicon oxidation in dry oxygen in the presence of HCl. A.I.Ellis, K.M.Gardiner, T.E.Cyr (Solid State Electronics Div., Honeywell Inc., Plymouth, MN, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.721-4 (March 1983).
Thermal oxidation of silicon to form a thin SiO_2 layer is one of the most important processes in VLSI and VHSIC technology. The authors propose a conceptually simple modification of the Deal-Grove model (1965) based on the assumption that the oxygen atoms impacting the oxide surface have a definite probability of penetrating to a certain depth. Expressions useful for data analysis and simulation (SUPREM II and III) are given. (13 refs.)

68676 Laser processing of thin surface layers in semiconductors. V.A.Zuev, V.G.Litovchenko, V.G.Popov.
Kvantovaya Elektron., Kiev (USSR), no.23, p.33-43 (1982). In Russian.
Methods of using laser light to investigate and control the characteristics of thin surface layers of semiconductors and of structures based on them are surveyed. Defect formation, changes in band and crystal structure, electrochemical and photochemical aspects, laser annealing of ion-implanted layers and the application of lasers in semiconductor device technology are discussed. (35 refs.)

68677 Surface morphology during ion etching. The influence of redeposition. R.Smith, S.S.Makh, J.M.Walls (Loughborough Univ. of Technol., Loughborough, England).
Philos. Mag. A (GB), vol.47, no.4, p.453-81 (April 1983).
Ion beam etching is a well-established technique for micro-machining surfaces. It is used extensively in surface analysis with techniques such as Auger electron spectroscopy, ESCA and SIMS, both for surface cleaning and composition-depth profiling. It is also a potentially important technique in semiconductor device fabrication, where the provision of vertical grooves is required and where redeposition is a potentially serious problem. In this paper a two-dimensional theory of the build-up of material redeposited during ion etching is presented, together with complementary experimental results which demonstrate the extent of the problem in the production of certain devices. The analysis is based on the method of characteristics, as in the theory of nonlinear waves, and computational examples are used to investigate the build-up of material on initially rectangular grooves as a function of beam energy and groove width. (23 refs.)

68678 AES study of the low-pressure oxidation of Si(100): electron beam effects. B.Carriere, A.Chouiyakh, B.Lang (Lab. de Cristallographie, Univ. Louis Pasteur, Strasbourg, France).
Surf. Sci. (Netherlands), vol.126, no.1-3, p.495-501 (March 1983). (ECOSS-5. Proceedings of the Fifth European Conference on Surface Science, Gent, Belgium, 24-27 Aug. 1982).
The growth of the oxide layer (0-25 Å) on Si(100) is followed by AES at 5×10^{-6} Torr O_2 and 25°C, using continuous electron beam irradiation. Three breaks in the AST plots are correlated with changes in Si bonding states deduced from the evolution of the fine structure of the Si LVV spectrum. A 4-step model is proposed: chemisorbed O, intermediate oxide, thin-layer SiO_2 and bulk-like SiO_2. (11 refs.)

68679 Cathodic protection of steel in sea water under heat-transfer conditions. P.E.Francis, A.S.Dolphin.
Report NPL-DMA(A)55, Nat. Phys. Lab., Teddington, England (June 1982), 44 pp.
The effect of heat transfer on the parameters required for cathodic protection of steel in sea water has been investigated. ASTM sea water was used for the study to ensure comparability between results. Heat transfer was varied by changing the internal temperature of the specimens between ambient and 110°C. The temperature of the water was either 5 or 20°C with linear flow velocities past the specimens of 5 or 50 cm s^{-1}. Under most conditions calcareous deposits which formed on the specimens were nonporous to oxygen and the cathodic currents were due to the reaction of water, but on pre-corroded surfaces the deposits were more porous so that cathodic currents were increased by oxygen reduction at the surface of the metal. Current densities on unheated specimens ranged from 10 mA m^{-2} for surfaces with good calcareous deposits to 7000 mA m^{-2} for bare surfaces when the flow velocity was 50 cm s^{-1}. The minimum cathodic potential required for protection of the steel specimens was not changed by heat transfer, and the corrosion rate was negligible at potentials more negative than −775 mV(Ag/AgCl) under all conditions. (14 refs.)

68680 Formation, transformation and dissolution of phases formed on surfaces. D.W.Shoesmith.
Report AECL-6840, Atomic Energy Canada Ltd., Chalk River, Ont. (March 1983), 63 pp.
The growth of films, and their transformation and dissolution reactions, coupled with such processes as stress and fatigue, are the essence of most industrial corrosion problems. A detailed understanding of the reaction mechanisms is essential if corrosion is to be prevented, or at least controlled. Corrosion studies require a multidisciplinary approach involving chemists, metallurgists and materials scientists. The author concentrates on the chemical and electrochemical aspects, with particular emphasis on some corrosion processes of interest to the Canadian nuclear industry. (49 refs.)

Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste ....See Entry 64593

An experimental comparison of alternative solid forms for Savannah River high-level wastes ....See Entry 65359

Processing effects on the behavior of titanate waste forms in aqueous solutions ....See Entry 65360

Immobilization of Savannah River high-level wastes in SYNROC: results from product performance tests ....See Entry 65363

Immobilization of high level nuclear reactor wastes in SYNROC: a current appraisal ....See Entry 65366

Rutherford backscattering investigation of the corrosion of borosilicate glass .. ..See Entry 65367

The development and testing of SYNROC C as a high level nuclear waste form ....See Entry 65368

Immersion and leach tests on solidified decontamination wastes from Dresden Unit 1 ....See Entry 65369

Stability of I and Sr radiophases in cement matrices ....See Entry 65370

Leaching studies of crystalline sodium phases in nuclear waste forms ....See Entry 65372

Lanthanide orthophosphates as a matrix for solidified radioactive defense and reactor wastes ....See Entry 65373

PNL-Sandia HLW package interactions test: phase one ....See Entry 65393

Mechanisms of dissolution of radioactive waste storage glasses and caesium migration from a granite repository ....See Entry 65394

Solidification of radioactive wastes with thermosetting resin ...See Entry 65407

Processing of titanates and zeolites and use of a cartridge system for 'reactor' wastes ....See Entry 65409

Performance of asphalt and clay liners as a uranium mill tailings leachate barrier ....See Entry 65410

A comparative assessment of TRU waste forms and immobilisation processes .. ..See Entry 65411

Leaching studies of radionuclides from solidifed wastes with thermosetting resin ....See Entry 65413

Hot-pressed barium sulphate ceramic waste forms for direct immobilisation of medium level Magnox waste ...See Entry 65417

Effects of waste composition and loading on the chemical durability of a borosilicate glass ...See Entry 65443

Chemical durability of glass containing SRP waste—leachability characteristics, protective layer formation, and repository system interactions ...See Entry 65444

The mechanisms for hydrothermal leaching of nuclear waste glasses: properties and evaluation of surface layers ...See Entry 65445

Long-term radioactivity release from solidified high-level waste. I. An approach to evaluating experimental data ...See Entry 65447

A flow model for the kinetics of dissolution of nuclear waste forms; a comparison of borosilicate glass, Synroc and high-silica glass ...See Entry 65448

Waste glass/repository interactions ...See Entry 65449

Leaching of vitrified high-level radioactive waste ...See Entry 65450

The role of metal ion solubility in leaching of nuclear waste glasses ...See Entry 65451

Relationship between glass leaching mechanism and geochemical transport of radionuclides ...See Entry 65452

Leaching of actinides from simulated nuclear waste glass ...See Entry 65453

Influence of a backfilling material on borosilicate glass leaching ...See Entry 65454

Effect of overpack materials on glass leaching in geological burial ...See Entry 65455

The interaction of borosilicate glass and granodiorite at 100°C, 50 MPa: implications for models of radionuclide release ...See Entry 65456

Burial effects on nuclear waste glass ...See Entry 65457

The chemical durability of some HLW glasses: effects of hydrothermal conditions and ionising radiation ...See Entry 65458

Determination of the corrosion mechanisms of high-level waste containing glass ...See Entry 65459

Results from a one-year leach test: long-term use of MCC-1 ..See Entry 65460

On the leaching behaviour of a simple borosilicate glass in a confined environment ...See Entry 65462

Chemical stability of simulated HLW forms in contact with clay media ...See Entry 65464

Dislocation etch pits & identification of slip systems in potassium perchlorate crystals ...See Entry 66999

CO_2 laser oxidation of silicon ...See Entry 67045

Glass surfaces—1982 ...See Entry 67318

Altered glasses: surface analysis study ...See Entry 67319

Application of nuclear analysis methods to nondestructive measurements of concentration profiles of the surface region of glasses by aqueous leaching ...See Entry 67320

Study of structural inhomogeneities in epitaxial layers of gallium arsenide ...See Entry 67392

Surface properties of tin dioxide single crystals ...See Entry 67753

Raman study of geometrical disorder at semiconductors surfaces ...See Entry 68207

Formation of silicon nitride fibers by nitriding silicon in a current of ammonia ...See Entry 68483

Use of vacuum metallography methods for evaluating the effectiveness of materials with protective coatings ...See Entry 68714

Compositional depth profile of a native oxide LPCVD MNOS structure using X-ray photoelectron spectroscopy and chemical etching ...See Entry 68837

81.60B Metals and alloys

(inc. stress corrosion cracking; anticorrosion)

68681 Impedance studies of the growth of porous magnetite films on carbon steel in high temperature aqueous systems. J.R.Park, D.D.MacDonald (Dept. of Metall. Engng., Ohio State Univ., Columbus, OH, USA).
Corros. Sci. (GB), vol.23, no.4, p.295-315 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
The growth of porous magnetite on carbon steel in high temperature chloride solution has been studied using the a.c. impedance technique. At both 200 and 250°C the reciprocal of the polarization resistance, which is proportional to the corrosion rate, at first increases with time, but eventually tends to a constant value. Accordingly, the early stages of corrosion are autocatalytic, but at longer times a linear rate law is observed. The early autocatalytic stage is attributed to the gradual development of a highly aggressive solution within the porous film due to cation hydrolysis and transport of chloride ions from the bulk solution into the pores. The frequency dispersion of the impedance of the growing film has been successfully accounted for by a finite transmission line model. Numerical analysis has shown that the total impedance is a sensitive function of the film thickness and of the impedances along the pore wall and at the base of the pore. (15 refs.)

68682 Determination of the long term corrosion behavior of coated steel with AC impedance measurements. M.Kendig, F.Mansfeld, S.Tsai (Rockwell Internat. Sci. Center, Thousand Oaks, CA, USA).
Corros. Sci. (GB), vol.23, no.4, p.317-29 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
A previous study (see F. Mansfeld et al., Corrosion vol.38, p.478, 1982) of the AC impedance of thin polymer films on aluminum alloys, steel, and phosphated steel, determined over a wide frequency range, has resulted in a general model for the electrochemical impedance across the coated surfaces. According to this model, penetration of the coating by the electrolyte results in an impedance behavior which is typical of a dielectric film short-circuited by conducting electrolytic paths perpendicular and parallel to the polymer/metal interface. Comparison of the time dependence of the impedance of coated steel substrates with the impedance across a free film has demonstrated that the corrosion of the substrate enhances the development of parallel paths of ionic conduction in the coating. AC impedance measurements carried out on polybutadiene-coated steels pretreated by different procedures determine quantitatively the resistance R_p of the conducting paths. (8 refs.)

68683 Chemical studies of polythionic acid stress-corrosion cracking. H.H.Horowitz (Exxon Res. & Engng. Co., Florham Park, NJ, USA).
Corros. Sci. (GB), vol.23, no.4, p.353-62 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
Low temperature stress corrosion cracking of sensitized stainless steel, promoted by aqueous solutions of polythionates $S_xO_6^{2-}$, and related sulfur compounds, particularly thiosulfates, has been a long known problem in the petroleum industry, and more recently has cropped up in the nuclear power industry. Membrane permeation results show that $S_4O_6^{2-}$ and $S_2O_3^{2-}$ do not function simply as sources of sulfide to promote hydrogen permeation and embrittlement. They do promote anodic dissolution also generating an unusual adsorption-related anodic spike in voltammetric scans. The oxidation of iron sulfide scales, said to be the source of the substances in petroleum refineries, has been shown to give rise mostly to Fe_2O_3 and elemental sulfur, with low yields of both $S_4O_6^{2-}$ and $S_2O_3^{2-}$. (10 refs.)

68684 Electrochemical aspects of stress-corrosion cracking of sensitised stainless steels. R.C.Newman, K.Sieradzki (Corrosion Sci. Group, Brookhaven Nat. Lab., Upton, NY, USA).
Corros. Sci. (GB), vol.23, no.4, p.363-78 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
The intergranular stress-corrosion cracking (SCC) of sensitised Type 304 stainless steel has been studied using sodium thiosulphate solutions at room temperature. Electrochemical aspects of the cracking have been examined using a potentiostatic scratching electrode technique applied to simulated grain boundary alloys. These results are compared with the current transients observed after intergranular fracture of embrittled specimens under the electrolyte. Dissolution kinetics within actual propagating cracks have been examined using load modulation. Rapid intergranular failure in a thiosulphate solution can be induced by successive load pulses of extremely short duration. Difficulties in accounting for the SCC velocities by an electrochemical mechanism are discussed. (16 refs.)

68685 Depassivation of iron by straining and by abrasion: an a.c. impedance study. M.Keddam, R.Oltra, J.C.Colson, A.Desestret (CNRS, Phys. des Liquides et Electrochemie, Univ. Pierre et Marie Curie, Paris, France).
Corros. Sci. (GB), vol.23, no.4, p.441-51 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
An a.c. impedance characterization of the mechanical damages caused in situ to the passive film on iron has been performed. Straining at constant rate and abrasion by projecting a suspension of particles are compared. The results are discussed in terms of the classical model involving a sequence of depassivation-repassivation events induced by local breakdown of the film. This model is able to account for the increase of d.c. passive current in both cases. From a.c. data it is concluded that breakdown occurs only under abrasion. This conclusion is corroborated by SEM of the abraded surface and the observation of individual peaks of current on the oscillographic trace. In the case of straining the results are consistent with a large plasticity of the film and no breakdown. A model accounting for the dependence of the d.c. current on the straining rate and for the main impedance features is proposed. (13 refs.)

68686 The leap from conventional to high energy plasma spraying. P.A.Lavin.
Int. J. Refráct. & Hard Met. (GB), vol.2, no.1, p.32-6 (March 1983).
Wear resistant coatings are extensively used to improve the working life of turbine blades and seals in gas turbine engines, to improve wear resistance of components in textile machinery and oil drilling tools, and in the chemical industry where they provide the benefit of both corrosion and wear resistance. The recent developments in the 'low energy' and 'high energy' plasma spraying of tungsten carbide, chromium carbide and chromium oxide-base powders is discussed in the following review. (2 refs.)

68687 Conforma Clad—a new process for customized coatings. M.R.Dustoor.
Int. J. Refract. & Hard Met. (GB), vol.2, no.1, p.37-40 (March 1983).
The Conforma Clad process offers a family of coatings that incorporate a unique blend of properties that have not been hitherto available to the end user. Without sacrificing wear resistance, which is comparable to the best thermal sprayed coatings, it offers low residual porosity together with excellent metallurgical homogeneity and superior bond strengths for coating thicknesses ranging from 0.010 to 0.100 inch. Complex geometries are easily coated without any major limitations on the physical and chemical characteristics of the starting powders which can be selected to provide the desired mix of final properties. (no refs.)

68688 Determination of parameters of electric protection for piping in a piecewise-uniform medium. V.V.Lukovich.
Elektrichestvo (USSR), no.1, p.42-6 (Jan. 1982). In Russian.
For corrosion protection the paper determines the potential and current density on the surface of the piping. Considers cases where the plane of division of the media is parallel to the pipe axis and transverse (or parallel) to the surface of the medium. A solution is obtained in closed form by the boundary integral equations method and quadrature formulae given in the paper. (3 refs.)

68689 'Secondary' heat, and reasons for infringement of the additivity of the rate of removal of metal undergoing electrochemical abrasive polishing. E.S.Varenko.
Elektron. Obrab. Mater. (USSR), no.1, p.39-41 (1983). In Russian. English translation in: *Electrochem. Ind. Process. & Biol. (GB)*
With the aid of representations of moving zones of ionization of a metal behind abrasive grains, an examination is made of the possibility of explaining the influence of operational factors and 'secondary' heat on the productivity of the electrochemical component in the process of electrochemical abrasive polishing. It is shown that an increase in the temperature of the surface layers of the metal during abrasive action can be one of the causes of infringement of the additivity of the rate of metal removal in electrochemical abrasive polishing. (4 refs.) *A.J.B.*

68690 Modification of the corrosion behavior of engineering alloys by ion implantation. C.R.Clayton, Y.F.Wang (State Univ. of New York, Stony Brook, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1752-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Ion implantation is emerging as a powerful and unique approach to corrosion protection. Several studies have demonstrated that the corrosion resistance of a number of ferrous and nonferrous commercial grade engineering alloys can be improved by ion implantation with suitable elements. The authors in which the localized and general corrosion behaviour of bearing steels, stainless steels and aluminum alloys have been significantly improved by ion implantation. The potential industrial application of this technique are considered. (18 refs.)

68691 Formulas of estimation of the critical quenching temperature for the carburization occurring in steels during vacuum oil-quenching. I.Ishigami, E.Tsunasawa, K.Yamanaka (Osaka Prefectural Industrial Res. Inst., Osaka, Japan).
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.314-21 (April 1983). In Japanese.
An equation describing the dependence of the critical quenching temperature upon size and shape of a specimen is developed as follows: $(T_{cf}+t_{qci}-T_b-T_l)(T_{cf}-T_{qci})(V_i/S_i)^{n'}=(T_{cf}+T_{qcj}-T_b-T_l)(T_{cf}-T_{qcj})(V_j/S_j)^{n'}$, where T_{cf} is the finishing temperature of carburizing, T_{qc} the critical quenching temperature, T_b and T_l the boiling temperature and the temperature of oil, respectively, V and S the volume and the surface area of a specimen, respectively and n' the size factor. The suffix i is used to indicate a notation for a reference specimen i and the suffix j for other specimens. Iron specimens were quenched in eleven kinds of oils. T_{qc} was measured, and T_{cf} was calculated by means of the analytical method which had been previously developed. n' was calculated to be 0.287 as a mean value. A regression analysis is carried out for the results and gives the following equations to a 17 mm×25 mm×1.75 mm iron plate used as a reference specimen i ($V_i/S_i=0.875$ mm): $T_{qci}=1377.5+10.81X+0.286T_2$ and $T_{cf}=685.7+0.525T_2$, where T_2(K) is the characteristic temperatures measured at the surface of a silver specimen (ϕ10 mm×30 mm), X(μm) the case depth of the iron plate quenched from 1473K. T_{qc} estimated with this method agrees well with T_{qc} measured for S15C and SUS304. (16 refs.)

68692 Carbide-dispersion carburizing of vanadium steels. A.Chiba (Dept. of Metall., Kumamoto Univ., Kumamoto, Japan), T.Saito, K.Yamaguchi.
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.321-8 (April 1983). In Japanese.
The formation of a carbide-dispersed layer (CD layer) by carburizing various vanadium steels at temperatures between 923 and 1273K was studied, and the wear characteristics of these vanadium steels were examined. A CD layer formed by carburizing below A_1 point contains fine platelet V_4C_3 carbides in a ferrite matrix. The crystal orientation relationships between ferrite and V_4C_3 carbide are $(100)(V_4C_23)\|(100)_{\alpha-Fe}$, $[010](V_4C_3)\|[011]_{\alpha-Fe}$ and $[001](V_4C_3)\|[0\bar{1}1]_{\alpha-Fe}$, known as the Baker-Nutting relationship. A CD layer grew in proportion to the square root of time, and the growth rate below A_1 point was explained by a kinetic equation proposed by Wagner for the internal oxidation. The permeability for carbon in Fe-V alloys is expressed as follows; $C_C{}^{(S)}(\mathrm{mass\%}).D_C{}^{\alpha}(\mathrm{m^2.s^{-1}})=1.10\times10^{-3}\exp(-167(\mathrm{kJ.mol^{-1}})/RT)$. Vanadium steels carburized and quench-tempered shows good wear resistance at both low and high sliding speeds, and a steel containing 2.3%V shows better wear resistance than SKD 11 steel. (19 refs.)

68693 Carburizing of dual-phase steel. S.Kamada, K.Hashiura (Dept. of Metallic Engng. for Materials, Akita Univ., Akita, Japan), T.Nishizawa.
J. Jpn. Inst. Met. (Japan), vol.47, no.4, p.359-64 (April 1983). In Japanese.
Carburized parts have been usually quenched twice; from above Ac_3 of the core for grain refinement, then from above Ac_1 for full hardening of the case. This two-step quenching often causes cracking and distortion. The applicability of dual-phase steel to case hardening material has been investigated, because these kinds of steels generally have a fine grain size at high temperatures, so that it has been usual practice to skip the 1st step quenching. 1-2%Si-0.3%Cr-0.01-0.25%C steels were prepared for examining the grain size and the mechanical properties after carburizing at 950°C, quenching being made from 850°C and tempering at 150°C. It has been found that the grain coarsening in the core scarcely occurs if the steel has the two-phase structure of $\alpha+\gamma$ at the carburizing temperature. While the depth and hardness of the case are somewhat reduced by the addition of 2%Si, the core shows the outstanding strength-ductility combination characteristic of dual-phase steel. (11 refs.)

68694 Structural characterization of laser-processed molybdenum steel. P.A.Molian (Dept. of Materials Sci. & Engng., Oregon Graduate Center, Beaverton, OR, USA).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.175-80 (April 1983).
Experiments were performed to study the effects of rapid melting and subsequent quenching on the microstructure and microhardness of laser-processed molybdenum steel. Molybdenum was flame sprayed onto the surface of an AISI 6150 (low alloy) steel substrate to a thickness of 25 μm; the surface of the steel was then melted using a 1200 W continuous wave CO_2 laser to produce an alloy containing 15% Mo to a penetration depth of 200 μm. The microstructure, characterized by scanning and thin foil transmission electron microscopy, consisted of δ ferrite cells with two types of carbide precipitation. Selected area diffraction investigations together with dark field microscopy studies identified these carbides as M_6C and Mo_2C. Fine Mo_2C carbide having the characteristic needle morphology was observed within the ferrite cells. The solidification carbide, namely M_6C, was found to occur in large quantities both at the intercellular boundaries and within the matrix. The matrix M_6C carbide exhibited spherical and rhombohedral morphologies while the cell boundary M_6C carbide had a lamellar morphology. It is proposed that these microstructural features enhanced the microhardness of the laser-alloyed fusion zone to 455 kgf $\mathrm{mm^{-2}}$ (44 HRC). (8 refs.)

68695 The study of variations in stress corrosion cracking velocities in aluminium alloy 7075-T651 by acoustic emission. J.I.Dickson, P.Martin, J.-P.Bailon (Dept. de Genie Metall., Ecole Polytech., Montreal, Quebec, Canada).
Mater. Sci. & Eng. (Switzerland), vol.58, no.2, p.L5-8 (April 1983).
Variations in stress corrosion cracking (SCC) velocities after the introduction of several drops of 3.5% NaCl solution into the crack mouth were followed using acoustic emission. It is suggested that studies of the factors influencing this variation may prove a useful method of studying the processes which control SCC kinetics. (12 refs.)

68696 Relevance of microstructure to stress corrosion cracking in Al-5% Zn and Al-5% Cu alloys containing titanium. M.V.Bhat, K.I.Vasu (Dept. of Metall., Indian Inst. of Sci., Bangalore, India).
Prakt. Metallogr. (Germany), vol.20, no.3, p.130-7 (March 1983).
The importance of microstructure on the stress corrosion cracking (SCC) of materials is assessed from the metallographic studies of fractured wire samples of Al-5% Zn and Al-5% Cu alloys in 1M NaCl solution. Addition of Ti to Al-Zn alloy improves the susceptibility of SCC as a result of improved grain boundary precipitation; whereas addition of Ti to Al-Cu alloy improves the resistance to SCC as a result of general precipitation of second phase and the chilling effect of Ti. Cold-worked alloys have superior SCC resistance over the annealed or aged ones as a result of breaking down of annealed/aged structure and random distribution of second phase particles. (6 refs.)

68697 Initial stages of the oxidation of zirconium studied by X-ray photoelectron spectroscopy and secondary-ion mass spectroscopy. D.P.Valyukhov, M.A.Golubin, D.M.Grebenshchikov, V.I.Shestopalova (Polytech. Inst., Stavropol, USSR).
Sov. Phys.-Solid State (USA), vol.24, no.9, p.1594-5 (Sept. 1982). Translation of: *Fiz. Tverd. Tela (USSR)*, vol.24, no.9, p.2816-18 (Sept. 1982). [received: April 1983]
Both the XPS and SIMS results show that the adsorption of oxygen on zirconium involves the formation of ZrO_2 on the surface to a monolayer coverage. Further oxidation in the bulk occurs via the diffusion of adsorbed oxygen through the ZrO_2 lattice to the metal-oxide interface. (7 refs.)

Meeting on Electrochemical Techniques in Corrosion Testing and Research	See Entry 64576
A radioisotope method of thickness measurement for rhodium plating on rings	See Entry 64888
Examination of tube samples 21-46 and 28-45 from the Ginna Nuclear Plant for intergranular attack	See Entry 65347
Twenty-six-inch pipe NDE instrument surveillance test	See Entry 65348
Corrosion of construction materials in clay environments	See Entry 65390
Photoelectrochemical study of TiNi alloy oxide layer	See Entry 67776
Formation of high asymmetric oxide tunnelling barriers on niobium and tantalum	See Entry 67805
Possibilities and limitations for the application of CVD-coated cemented carbide tools and steel tools	See Entry 68452
Selective etching and laser melting studies of monotectic composite structures	See Entry 68510
Arsenic and platinum deposition during cathodic hydrogenation	See Entry 68647
Wear of aluminium under dry sliding conditions	See Entry 68666
Computer-assisted d.c. and a.c. techniques in electrochemical investigations of the active-passive transition	See Entry 68698
The use of micro-electrodes in the study of localised corrosion in aluminium alloys	See Entry 68699
Electrochemical methods for testing the intergranular corrosion susceptibility of stainless steels	See Entry 68701
Electrochemical evaluation of hot corrosion resistance of metallic materials	See Entry 68702
Application of in-air PIXE for corrosion-erosion studies of metal surfaces	See Entry 68822
Deposition characteristics of corrosive salts in electric steam generating systems using ion beam analysis	See Entry 68826
Metal oxidation as a heat pump	See Entry 68897

81.70 MATERIALS TESTING

(inc. sample preparation for examination, metallographic techniques, ion and electron microprobe techniques, Auger and photoelectron techniques, defectoscopy; for measurement in the mechanics of solids and rheology, see 46.30R)

68698 Computer-assisted d.c. and a.c. techniques in electrochemical investigations of the active-passive transition. B.Elsener, H.Bohni (Inst. of Materials Chem. & Corrosion, Swiss Federal Inst. of Technol., Zurich, Switzerland).
Corros. Sci. (GB), vol.23, no.4, p.341-52 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
The interrupter technique presented, using a computer assisted data acquisition and calculation method, allows the determination of the ohmic potential drop (*IR*-drop) in potentiostatic experiments. The results obtained for the passivation of a 304 stainless steel in low conductivity ethanol/water solutions containing hydrogen chloride show the importance of the accurate correction of the *IR*-drop to calculate the correct kinetic parameters. Impedance measurements give the same values for the ohmic resistance as the computer-assisted interrupter technique. The complex plane plots of the impedance show three capacitive loops before the current density reaches its maximum. (15 refs.)

68699 The use of micro-electrodes in the study of localised corrosion in aluminium alloys. C.D.S.Tuck (Alcan Internat. Ltd., Banbury, England).
Corros. Sci. (GB), vol.23, no.4, p.379-89 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
Micro-electrodes of three types: silver/silver chloride, tin/tin oxide and calomel, were constructed and evaluated aon their usefulness in identifying local anodic and cathodic sites on aluminium wild specimens and an aluminum alloy surface as they were scanned mechanically over a polished surface. The solution environment in which the specimens were placed was shown to have a critical effect on the detectability of local electrode sites and a solution of low conductivity was shown to be essential if the electrodes were microscopic in size. The modified calomel electrode which was able to be used in dry conditions showed the most usefulness in detecting electrode potential differences during a scan although its coarseness was found to be disadvantageous. (16 refs.)

68700 Electrochemical measurements in flowing solutions. B.Poulson (NEI Power Engng. Ltd., Gateshead, England).
Corros. Sci. (GB), vol.23, no.4, p.391-430 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
Fluid flow can influence both the rate and type of corrosion. Despite this most corrosion tests especially those involving electrochemical measurements are carried out under poorly characterized and unrepresentative hydrodynamic conditions. The author reviews the characteristics of existing specimens and then describes the development of a new design. Both the practical, including monitoring, and mechanistic significance of electrochemical measurements in flowing environments are then discussed. (103 refs.)

68701 Electrochemical methods for testing the intergranular corrosion susceptibility of stainless steels. P.Aaltonen, I.Aho-Mantila, H.Hanninen (Metals Lab., Tech. Res. Centre of Finland, Espoo, Finland).
Corros. Sci. (GB), vol.23, no.4, p.431-40 (1983). (Meeting on Electrochemical Techniques in Corrosion Testing and Research, Manchester, England, 4-6 Jan. 1982).
In addition to the standardized intergranular corrosion testing methods to detect sensitization in austenitic stainless steels, electrochemical test methods, i.e. the potentiokinetic reactivation test (EPR) and the anodic polarization,

and constant potential etching methods in perhcloric acid solution containing sodium chloride, have been developed. The results of these electrochemical measurements are compared with those obtained from copper sulfate-sulfuric acid tests. (18 refs.)

68702 Electrochemical evaluation of hot corrosion resistance of metallic materials. U.Ducati, G.Lecis Coccia, G.Caironi (Dept. of Appl. Phys. Chem., Politecnico di Milano, Milan, Italy).
Mater. Chem. & Phys. (Switzerland), vol.8, no.2, p.135-45 (Feb. 1983).
A fast, effective method for the evaluation of hot corrosion resistance of metallic materials is presented. This method is based on the extension to high temperature field of electrochemical techniques for the study of corrosion in aqueous environments. Its results are consistent with those obtainable by thermogravimetric techniques or by bench testing. An application example is given. (3 refs.)

68703 Edge effects in composites by moire interferometry. R.Czarnek (Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA), D.Post, C.Herakovich.
Exp. Tech. (USA), vol.7, no.1, p.18-21 (Jan. 1983).
Many aspects of the physical behavior of composite materials can be observed and quantified by moire interferomety. With the very high sensitivity of moire interferometry, the experiments are conducted at a low average strain and stress level, assuring linear and elastic behavior of the composite material. Sensitivity corresponding to moire with 2450 l/mm (62,230 l/in.) was achieved, namely 0.408 μm per fringe (16.1 μin./fringe). The displacement field on the specimen face and edge was observed simultaneously. Good fringe definition was achieved, even though the specimen was only 1 mm thick and the gradients were high. Use of a carrier pattern and optical filtering were effective even for these conditions. The existence of edge effects and dramatic displacement gradients were corroborated for angle-ply composite laminates. (6 refs.)

68704 The Iosipescu shear test as applied to composite materials. D.E.Walrath, D.F.Adams (Dept. of Mech. Engng., Univ. of Wyoming, Laramie, WY, USA).
Exp. Mech. (USA), vol.23, no.1, p.105-10 (March 1983).
A history of the Iosipescu shear test as applied to composite materials is presented along with a description of the test fixture and specimen design. Iosipescu's shear test is compared to similar test techniques, including the asymmetrical four-point bending (AFPB) test. Finally, in-plane and through-the-thickness shear properties measured using the Iosipescu shear tests are presented for a variety of materials, including a unidirectional graphite/epoxy, random and continuous-fiber sheet molding compounds, and two polymer materials. (39 refs.)

68705 Spatial resolution in industrial tomography. Be-shan Chiang, S.R.Gautam, F.F.Hopkins, I.L.Morgan (Scientific Measurement Systems Inc., Austin, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1671-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The parametric dependence of spatial resolution on tomographic parameters is investigated. The influence of Computerized Tomographic parameters, such as the number of angular views, ray spacings in a fan beam, the degree of collimation, and the magnitude of the object opacity, on the spatial resolution is studied. The research was carried out using a specially designed resolution phantom. The phantom was designed to incorporate features of varying sizes, shapes and mass densities. An index of resolution is defined to quantatively express the results of this study. (23 refs.)

68706 Compton interaction tomography. I. Feasibility studies for applications in earthquake engineering. S.R.Gautam, F.F.Hopkins, R.Klinksiek, I.L.Morgan (Scientific Measurement Systems Inc., Austin, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1680-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Feasibility of applying Compton Interaction Tomographic (CIT) processes for nondestructive testing of massive extended systems is studied on a laboratory prototype device. The principles of Compton interaction between electromagnetic radiation and matter underlie the technique. Experimental studies are conducted to detect features such as iron rebars and air voids contained in a concrete medium. Computer simulation studies have been made to supplement experimental results. (2 refs.)

68707 An optical emission spectrographic method for the determination of niobium in steels. S.V.Grampurohit, S.S.Biswas, V.S.Dixit (Spectroscopy Div., Bhabha Atomic Res. Centre, Bombay, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.978-81 (Dec. 1982). [received: April 1983]
An optical emission spectrographic method for the determination of niobium in steels in the range from 0.1 to 2% Nb is described. The sample is converted to oxide through acid dissolution and mixed with buffer and graphite in the ratio 1:2. The mixture is subjected to DC arc excitation using graphite electrodes. The resulting spectrum is recorded on a Kodak SA-1 emulsion using a Hilger large quartz spectrograph. A pre-arc period of 30 s and an exposure of 30 s are adopted. Two lines of niobium at 2583.986 and 2590.944 Å are selected as analysis lines while the iron line at 2587.999 Å is used as internal standard line. The method shows a mean standard deviation of ±15%. (5 refs.)

68708 A modulus method of determining the type of rolling texture in sheets of hexagonal metals. V.S.Ivanii, N.V.Ivanii, V.S.Kshnyalin (Makarenko Teacher-Training Inst., Sumi, USSR).
Ind. Lab. (USA), vol.48, no.7, p.662-7 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.28-31 (July 1982). [received: March 1983]
The relationship between the texture and the anisotropy in the elastic properties is considered in a simplified scheme for representing the orientation distribution of hexagonal crystals, and a method is proposed of determining the type and character of the texture dispersion by measuring the anisotropy in the elastic modulus in the plane of a sheet of the material. The results show that the method is particularly effective for routine monitoring of sheet texture for a particular grade of metal in order to predict the anisotropy in the physicochemical properties of the semifinished product and to choose the optimum way of using this anisotropy to improve the working characteristics. (8 refs.)

68709 Scope for monitoring the thermomechanical hardening of steel from the martensite X-ray line intensity and shape. L.M.Kaputkina, S.D.Prokoshkin, V.E.Mozzhukhin, L.A.Zav'yalova, N.A.Nikishov (Moscow Inst. of Steel & Alloys, Moscow, USSR).
Ind. Lab. (USA), vol.48, no.7, p.667-74 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.32-8 (July 1982). [received: March 1983]
Considers the scope for using X-ray texture analysis of the martensite, where one employs the effects of the texture in the initial austenite on the fairly strong lines of the martensite at low indices, as are usually examined in analyzing the lattice. (11 refs.)

68710 Diffractometer determination of the fine-structure parameters in surface layers of a material. N.L.Baturinskaya, N.A.Kal'chuk, V.G.Chernyi (Inst. of Casting Problems, Acad. of Sci., Kiev, Ukrainian SSR).
Ind. Lab. (USA), vol.48, no.7, p.674-6 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.38-40 (July 1982). [received: March 1983]
The following aspects of the glancing beam method have been examined: a) to develop an analogous method for a diffractometer (with ionization or scintillation recording); b) to estimate the fine-structure parameters (size of the coherent-scattering regions and the lattice microdistortion) at depths of 0.1-10 μm; and c) to compare the results obtained in this way with those from the standard techniques. The object was an Fe-Cr-Mn-C alloy based on iron with an FCC lattice deformed by friction. The results indicate that the glancing-beam method as applied to an X-ray diffractometer is reliable and can be used to examine the structures of thin surface layers (<1 μm) and to examine the changes in characteristics of the surface layer in the range 0.1-10 μm. (6 refs.)

68711 Energy factors of build-up of X-irradiation. A.P.Shpagin, I.M.Rubinovich (Tomsk Polytech. Inst., Tomsk, USSR).
Ind. Lab. (USA), vol.48, no.7, p.690-3 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.49-51 (July 1982). [received: March 1983]
The energy factors of build-up behind an iron layer were calculated by the Monte Carlo method. A planar monodirectional and monoenergetic source was selected. Incoherent scattering and the photoelectric effect were taken into account in the modelling of the trajectories of gamma quanta. For the given set of the trajectories, the spectra were obtained immediately behind 12 thicknesses of the absorber from 3 mm to 8 cm. To increase the statistical accuracy of the calculations, absorption was averaged out analytically and an exponential transformation was carried out. The trajectory of the gamma quantum was followed until its energy dropped below 8 keV. The statistical accuracy of the calculations of the energy factor of build-up was $\sim$10%. (7 refs.)

68712 A spectroscopic method of determination of the perfection of the crystal structure of the surface of silicon sheets. L.N.Didrikil' (Sci.-Res. Inst. of the Watch Industry, Uglich, USSR).
Ind. Lab. (USA), vol.48, no.7, p.694-6 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.51-3 (July 1982). [received: March 1983]
The author describes a rapid nondestructive method of inspection of the perfection of the crystal structure of the surface of semiconductors using light reflection. The reflection spectra of silicon sheets treated by various methods are shown. Reflection was measured in an SF-26 spectrometer with a reflection attachment. The angle of incidence of the beam on the specimen was 10°. The spectra characterize the degree of perfection of the crystal structure of the surface. (2 refs.)

68713 Use of domestic ultrasonic inspection equipment for thick-rolled sheet. N.N.Timoshenko, V.M.Verevkin, V.A.Kashirin.
Ind. Lab. (USA), vol.48, no.7, p.697-8 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.53-4 (July 1982). [received: March 1983]
High sensitivity and the possibility of automating the ultrasonic inspection process have been combined in the through-echo flaw-detection method. In it the ultrasonic transducers are positioned in exactly the same way with respect to the object being inspected as for the shadow method, i.e., on either side. Thus in one equipment the shadow and through-echo methods can be combined. (6 refs.)

68714 Use of vacuum metallography methods for evaluating the effectiveness of materials with protective coatings. L.B.Getsov, A.I.Rybnikov, E.Ya.Ol'shanskaya.
Ind. Lab. (USA), vol.48, no.7, p.719-23 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.74-7 (July 1982). [received: March 1983]
Questions of evaluating the effectiveness of coatings under conditions of static and thermocyclic loads with the use of vacuum metallography methods are considered. Methods of tensile testing and thermal fatique testing are described. (7 refs.)

68715 A statistical method of determining the early signs of necking. M.A.Kibardin (Shadrinsk Teaching Inst., USSR).
Ind. Lab. (USA), vol.48, no.7, p.723-5 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.77-8 (July 1982). [received: March 1983]
The proposed method of determining the early signs of necking in a sample based on the start of a steady increase in the coefficient of mutual correlation of series of pairs of units of the deformed field with an increase in the degree of macrodeformation is based on the method of coordinate networks. The investigations were made on AD1-M aluminium. The samples with a gauge length of 60×22×3 mm were cut from sheet in the rolling direction. Before testing they were annealed at 480°C for 3 h and then furnace cooled to room temperature. An orthogonal network with a base of 1 mm was applied to the working surface of the sample on a UIM-21 microscope with a diamond cutter with an accuracy of ±2 μm. (4 refs.)

68716 A unit for investigating microplastic deformations. S.A.Aleksandrov, O.V.Zernov, V.V.Ostashev, V.V.Shevel'kov (Kalinin Leningrad Polytech. Inst., Kalinin, USSR).
Ind. Lab. (USA), vol.48, no.7, p.730-1 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.81-3 (July 1982). [received: March 1983]
A test unit is described for automatically recording the accumulation of microplastic deformations with output of the information in a form convenient for direct entry into the computer. Operator participation in the measurements is completely eliminated. (no refs.)

68717 Heating unit for mechanical testing of heat-resistant alloys at high temperatures. F.Z.Utyashev, B.V.Rodionov, R.G.Baimurzin (Ufa Aviation Inst., Ufa, USSR).
Ind. Lab. (USA), vol.48, no.7, p.731-4 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.83-4 (July 1982). [received: March 1983]
A heating unit is described which can be used along with devices for mechanical testing of heat-resistant materials under superplasticity conditions. The unit consists of a 'Sandugach' PST-10-22.0 miniature semiconductor frequency converter; a high-temperature furnace chamber; an automatic control system for measuring and regulating the test temperature; and a loading device. (no refs.)

68718 Automated testing systems with hydraulic force excitation. Yu.E.Tyablikov, O.A.Levin.
Ind. Lab. (USA), vol.48, no.7 (July 1982). Translation of: *Zavod. Lab. (USSR)*, vol.48, no.7, p.84-92 734-43 (July 1982). [received: March 1983]
The authors review the present state-of-the-art in computer-controlled test systems and conclude that they make it possible to employ a systematic approach to the automation of experiments in the analysis of the strength of structures on a single element basis. Taking into account the amplitude-frequency characteristics and metrological parameters of testing machines, the problems associated with the examination of the mechanical properties of

materials, experimental and numerical determination of nonuniform stress states in zones of stress raisers, and the problems of tests on models and components of machines and of the estimation of the service life of structures can be solved comprehensively. (18 refs.)

68719 Toward a pure shear specimen for K_{IIc} determination. L.Banks-Sills, M.Arcan (Dept. of Solid Mech., Tel Aviv Univ., Ramat Aviv, Israel), H.D.Bui.
Int. J. Fract. (Netherlands), vol.22, no.1, p.R9-14 (May 1983).
Reports on a newly developed specimen which is proposed for use in accurately measuring K_{IIc}. The specimen presented is a modification of one which was developed for other purposes (Arcan et al., 1978), in which by loading in only one direction it is possible to obtain a narrow region of nearly uniform pure shear. (8 refs.)

68720 Fracture toughness tests on an aluminium alloy using a chevron notch bend specimen. L.P.Pook (Nat. Engng. Lab., Glasgow, Scotland).
Int. J. Fract. (Netherlands), vol.22, no.1, p.R21-3 (May 1983).
The results of experiments on chevron notch specimens are reported. It was concluded that for a material with a rising crack growth resistance curve, K_{Ic} could not be measured using chevron notch specimens. (5 refs.)

68721 A facility for precise measurement of mechanical properties at elevated temperatures. E.T.C.Ho (Ontario Hydro, Toronto, Ontario, Canada), S.R.MacEwen.
J. Met. (USA), vol.35, no.2, p.25-9 (Feb. 1983).
A test facility consisting of an environmental chamber, a remote extensometer, and a miniature three-zone furnace has been developed for use with a computerized model 1116 Instron. Experiments can be done in either vacuum or inert gas. The temperature of the specimen is controlled from three 125-μm-diameter, bare-wire, type K thermocouples which are spot welded to the sample. Over the 2.5-cm-gage length, the temperature is constant to within 1K, and there is negligible control ripple. A remote extensometer, which attaches to the shoulders of the sample, allows the strain to be measured continuously using a standard, clip-on strain gage. Examples of tensile tests, creep tests, stress-drop tests, and stress relaxation, using Zr-2.5 wt.% Nb specimens at temperatures in the vicinity of 0.5 T_m, are presented. (8 refs.)

68722 A plane strain tensile apparatus. H.Sang (Alcan Internat. Ltd., Kingston, Ontario, Canada), Y.Nishikawa.
J. Met. (USA), vol.35, no.2, p.30-3 (Feb. 1983).
A simple clip-on apparatus has been designed to deform a modified sheet tensile specimen in a state of plane strain. The apparatus consists of a sprung clamp having four knife edges to prevent specimen edge pull-in. Both the plane strain limit strain and fracture strain are obtained from measurements on the fractured sample. Results compare favorably with previously published data. In addition, the apparatus has been used to measure the plane strain formability parameters at non-ambient temperatures. (9 refs.)

68723 Predicting heat-affected zone hardness by the weld test method. M.J.Bibby, Lan-meng Chong, Goldak J.A. (Dept. of Mech. Engng., Carleton Univ., Ottawa, Canada).
J. Test. & Eval. (USA), vol.11, no.2, p.126-33 (March 1983).
The 'weld test method' of predicting heat-affected zone (HAZ) hardness first suggested by Stout et al. (1945) is further developed in this investigation. The contemporary heat flow analysis of Adams (1958) and Jhaveri et al. (1962), and conclusions from the recent particularly relevant hardness-heat flow investigation of Graville (1973) are incorporated into the model. A 'welding hardness diagram' is suggested to represent to the test data and to simplify the task of predicting HAZ hardness. Experimental hardness results are compared to predicted values for a relatively wide range of carbon-manganese and low alloy structural steels in support of the welding hardness diagram approach. The relative merits of this procedure compared to the recent mathematical methods suggested by Bastien et al. (1970) and by Arata et al. (1972) for predicting HAZ hardness are discussed. (20 refs.)

68724 Confidence limits of stress values measured by X-ray diffraction. M.Kurita (Dept. of Mech. Engng., Technol. Univ. of Nagaoka, Nagaoka, Japan).
J. Test. & Eval. (USA), vol.11, no.2, p.143-9 (March 1983).
The confidence limits of stress values measured by X-ray diffraction are usually determined from the equation of the t distribution for the linear regression analysis. Experimentation has shown that not all of the four assumptions on which the equation is based hold for X-ray stress measurement. X-ray residual stress measurement on a quenched structural steel was repeated 65 times. A slight failure of the assumption of linearity of the $\sin^2\psi$ diagram gives confidence limits of the stress determined from the equation 1.5 to 6 times larger than the actual values depending on the preset times used. However, the confidence limits of the stress determined from the equation derived analytically from X-ray counting statistics agree very closely with the actual values. The standard error of the confidence limits determined from this equation is much smaller than that determined from the equation of the t distribution by a factor of $^1/_{15}$ to $^1/_{67}$. (11 refs.)

68725 Accuracy and precision of crack length measurements using a compliance technique. R.L.Hewitt (Structures & Materials Lab., Nat. Res. Council of Canada, Ottawa, Ontario, Canada).
J. Test. & Eval. (USA), vol.11, no.2, p.150-5 (March 1983).
A compliance crack measurement technique has been implemented in a computer-controlled fatigue crack growth rate test written to conform to the ASTM test for constant-load-amplitude fatigue crack growth rates above 10^{-8} m/cycle (E647). The use of a 'correction' factor in the compliance expression is discussed and relevant details of the computer implementation are provided. Possible sources of error in the technique have been investigated and the relative precision and absolute accuracy determined using 12.6-mm-thick compact tension specimens of 2024 T351 (unified numbering system [UNS] A92024) aluminum having widths of 51 mm. The relative precision of individual measurements using standard fixtures was found to be about 0.05 mm, but this can be reduced to as little as 0.01 mm by averaging over 20 measurements. For most crack lengths, the calculated lengths were within 0.25 mm of the average physical crack lengths measured from profiles on fractured specimens. (4 refs.)

68726 High pressure fatigue testing with results for tubing and fittings. W.N.Findley, R.M.Reed (Div. of Engng., Brown Univ., Providence, RI, USA).
J. Test. & Eval. (USA), vol.11, no.2, p.156-9 (March 1983).
Means are described for raising by a factor of about three the allowable cyclic pressure provided by a high pressure fatigue machine for fatigue testing of thick-walled tubes. Fatigue test results are given for 7.9- and 6.4-mm high pressure tubing of 316 stainless steel, crosses, tees, and seals. (4 refs.)

68727 Analysis of surface states by the Kirlian effect.
Mes. Regul. Autom. (France), vol.48, no.3, p.63, 65-6 (7 March 1983). In French.
Nondestructive testing by recording of surface discharges in a strong alternating electric field is described. In one variant, the sample is placed between a metallic electrode and an insulating Mylar sheet in contact with a transparent conductive electrode of glass coated with a thin layer of tin oxide, through which the luminous discharges are photographed by a Polaroid camera. A direct-recording alternative uses the metallic sample itself as the earth electrode, and the photosensitive film is placed between it and the HT electrode. The physical principle of the method is explained. A test piece with a tapered rectangular depression has been used at the University of California to measure the relationship between thickness of the air gap and the onset of the luminous discharge. The method's potential for inspection of surface conditions after mechanical or thermal treatment is assessed. (no refs.) *M.B.D.*

68728 Automated inspection of corroded steel structures. A.Singh, R.McClintock (Southwest Res. Inst, San Antonio, TX, USA), T.W.Rudwick, R.L.Brackett.
Mater. Eval. (USA), vol.41, no.5, p.568-70 (April 1982). [received: May 1983]
Deterioration caused by corrosion of steel can result in catastrophic failures of waterfront facilities and other offshore structures. Inspection of corroded steel structures is largely limited to visual examination. However, this is not a reliable nondestructive method for thickness measurement because it is limited to assessing surface damage. A novel ultrasonic concept has been developed and integrated into an automated scanning system. This concept uses a focused ultrasonic transducer centered over a corroded pit so that the pit acts as an acoustic lens. Special transducer modification and pattern analysis techniques have been developed to overcome the effects of spurious signals. Scanning of the corroded area, alignment of the focused transducer over the pits, and acquisition and processing of the signals to determine the thickness of corroded steel are performed by the computer-controlled system. An average thickness measurement error of only four percent was achieved using this system. (3 refs.)

68729 A proposed ultrasonic inspection technique for offshore structures. M.D.Fuller, J.B.Nestleroth, J.L.Rose (Dept. of Mech. Engng., Drexel Univ., Philadelphia, PA, USA).
Mater. Eval. (USA), vol.41, no.5, p.571-8 (April 1982). [received: May 1983]
The need for nondestructive evaluation (NDE) procedures for tabular joints in offshore structures is emphasized by every platform collapse. A new microprocessor-based ultrasonic inspection technique for tubular joints has been devised and preliminary tests conducted. The inspection concepts and the sensitivity of the technique to damage has been evaluated utilizing a 1/3 scale structural K-joint. The inspection concepts are discussed; in addition, the results of the 1/3 scale K-joint fatigue test are presented. Additional laboratory experiments were conducted to determine the effects of a marine environment and other limiting conditions on the sensitivity and feasibility of the technique. These results are also discussed. (11 refs.)

68730 Method for measuring transducer movement during underwater ultrasonic evaluation of weld flaws. W.S.Burkle (Phillips Petroleum Co., Bartlesville, OK, USA).
Mater. Eval. (USA), vol.41, no.5, p.579-81 (April 1982). [received: May 1983]
Underwater ultrasonic weld testing is considerably more difficult than testing work conducted on the surface. A difficulty particularly present during underwater ultrasonic testing (UT) is the ability to accurately measure flaw dimensions using beam boundary intercept and other common defect-sizing techniques. Because flaw measurement constitutes a considerable portion of the data needed for critical evaluation of weld acceptability, accuracy is of the utmost importance. The author discusses a method for improving flaw measurement accuracy utilizing ultrasonic echo-ranging techniques that employ a separate transducer and test instrument to monitor probe movement. (no refs.)

68731 The magfoil method. K.G.Walther (Henrichs & Walther GmbH, Bocholt, Germany).
Mater. Eval. (USA), vol.41, no.5, p.582-5 (April 1982). [received: May 1983]
The magnetographic system represents a new method for underwater weld inspection. The diver's function is relatively simple and can be carried out by non-NDE qualified personnel. The system provides objective test results that are distinguished by reliability and reproducibility. These results can be stored and compared with results obtained in earlier inspections. (no refs.)

68732 Magnetographic weld inspection system for underwater installations. W.Stumm (Inst. Dr. Forster, Reutlingen, Germany).
Mater. Eval. (USA), vol.41, no.5, p.586-8 (April 1982). [received: May 1983]
A new underwater tool for magnetic inspection of welds is described. This tool enables separation of a diver's work and the evaluation procedure. The results from the inspected weld areas are shown in a two-dimensional C-scan. (no refs.)

68733 Determination of fatigue strength of plastics according to up-and-down method. M.Nowak (Politech. Wroclawska, Wroclaw, Poland).
Mech. Teor. & Stosow. (Poland), vol.19, no.2, p.301-13 (1981). In Polish.
The statistical analysis of 60 up-and-down method diagrams was carried out to find the minimum number of samples required for determination of the fatigue strength of plastics. Based on sequential analysis, evidence is given that if the value of the cumulative function is not greater than 3 per cent of the size of set taken as parent population, then the determination of fatigue strength can be carried out for a number of samples not less than 22. The applicability of a modified up-and-down method for determination of the fatigue limit is verified. It is found that in this pattern of calculation the number of samples may be reduced by 10 per cent. As the experimental set of diagrams represents a relatively wide class of plastics and test parameters, the applicability of the conclusions to other materials with dispersion within the limits of the tested set, was found possible. (30 refs.)

68734 Delineation of the microstructure of high alloy CrNi, CrNiW and CrNiCoW steels by deep etching. G.Herbsleb, P.Schwaab (Mannesmann Forschungsinst. GmbH, Duisburg, Germany).
Prakt. Metallogr. (Germany), vol.20, no.2, p.53-63 (Feb. 1983). In English, German.
Tests were carried out on very complex high alloy CrNi, CrNiW and CrNiCoW materials. For the majority of the investigated materials etching at room temperature in alcoholic HCl (9 parts by volume methanol to 1 part HCl) in the active region (U_H=0.250 V, etch time approx. 60 min.) was suitable to reveal the spatial microstructure. For two materials containing Co and W, the latter in varying amounts, there were difficulties due to formation of a protective layer. No satisfactory deep etching method was found for the material with low W content even in other electrolytes (HCl solutions of various concentrations and at various temperatures) by holding potentiostatically in the active region or in HF without an externally applied current.

Surprisingly the structure of the Co and W containing materials with higher W content could be revealed in aqueous solutions of HCl. (7 refs.)

68735 Applications of analytical electron microscope in metal structure analysis. Energy dispersive spectroscopy (EDS). K.Uehara, Y.Takano (Nagasaki Tech. Inst., Mitsubishi Heavy Industries Ltd., Nagasaki, Japan).
Prakt. Metallogr. (Germany), vol.20, no.2, p.74-84 (Feb. 1983). In English, German.
Presents the results of extraction replica analysis on the metal structures of several types of routinely-used high temperature steel, and discusses the usefulness of the analytical electron microscope. (no refs.)

68736 Metallographic characterization of PM material. W.J.Huppmann, K.Dalal (Sintermetallwerk Krebsoge GmbH, Radevormwald, Germany), P.Wellner, G.Elssner.
Powder Metall. (GB), vol.26, no.1, p.23-30 (1983).
A systematic characterization is made of the most important PM materials which are used in the production of sintered parts. For this purpose both literature data and new experimental results are used. The description of the metallographic preparation techniques is followed by three sections on: (i) characterization of the porosity classes of sintered materials; (ii) characterization of surface treatments—steam treatment, galvanizing, and mechanical plating; and (iii) characterization of case hardened sintered steels. (8 refs.)

68737 Reappraisal of results of transverse rupture tests for hardmetals. T.J.Griffiths (Dept. of Mech. & Production Engng., Polytech. of Wales, Pontypridd, Wales).
Powder Metall. (GB), vol.26, no.1, p.42-3 (1983).
An equation is presented for calculating strength values from transfer rupture tests that gives better agreement between results using different test pieces. Allowances are made for the effect of contact stresses under the point of application of the load. (2 refs.)

68738 Fatigue crack advance presumably detected by acoustic emission signals. C.J.Kim, Guo-zhi Lu, J.Weertman (Dept. of Materials Sci. & Engng., Northwestern Univ., Evanston, IL, USA).
Scr. Metall. (USA), vol.17, no.3, p.359-64 (March 1983).
An acoustic emission (AE) technique was used to check the predictions of the authors' fatigue crack growth theory. The study shows that the predictions of the theory seem to be in agreement with the experimental results. In fourth power type law material the fatigue crack extension AE signal appears when the stress reaches its maximum value in a load cycle. On the other hand, in a second power type law material (maraging 300 steel) the crack extension AE signal occurs when the stress is still well below its maximum value. (6 refs.)

68739 Comments on: deformation twins in punched specimens of a 321 steel. L.E.Murr (Oregon Graduate Center, Beaverton, OR, USA).
Scr. Metall. (USA), vol.17, no.3, p.423-4 (March 1983).
Comments are made on a paper by Newcomb and Stobbs (see ibid., vol.16, p.1153, 1982) in which they conclude that the punching process effectively focuses a shock wave at the centre of the disc where it will be subsequently thinned. They also assert that spark cut, rather than punched discs should be used in TEM studies of the deformation microstructure and transformation behaviour. The present authors point out that disc punching of thin sheet specimens for TEM analysis and diagnosis certainly should not be a deformation process, and that the formation of deformation twins is indicative of improper punching technique. (5 refs.)

68740 Deformation in punched specimens of type 304 stainless steel. M.E.Kassner (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Scr. Metall. (USA), vol.17, no.3, p.425-6 (March 1983).
In a recent paper on deformation twins in punched specimens of a 321 steel (see ibid., vol.16, p.1153, 1982) Newcomb and Stobbs examined the microstructure of spark-cut and mechanically punched disks under the transmission electron microscope (TEM). They concluded that the mechanical punching of disk produced plastic deformation at the center of the disk, where it was subsequently electrochemically thinned. The plastic deformation was evidenced by profuse mechanical microtwinning. The present author presents the results of an analogous comparison study on 304 stainless steel spark-cut/punched disks. Because the mechanical properties of 304 and 321 stainless steels are essentially equivalent, the results described here place the findings of Newcomb and Stobbs for 321 stainless steel in question. (5 refs.)

68741 Enhancing the information yield of the ultrasonic inspection of welded joints with a permanent backing ring. V.V.Gorskii, V.T.Pronyakin, G.V.Dubinin.
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.594-7 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.19-22 (Aug. 1982). [received: April 1983]
A procedure is described for enhancing the information yield of the ultrasonic inspection of welded joints with a permanent backing ring in testpieces having a tubular configuration with a thickness of 2-5 mm, namely by recording separately the reflected pulses from flaws and from the sidewalls of the backing ring. It is shown that the size of weld flaws and the degree of fusion of the backing ring can be determined from the ratio of the amplitudes of these pulses. Focusing combination double transceiver probe configurations are given, along with a block diagram of a flaw detector with a tracking gate pulse, which is capable of detecting flaws with diameters of 0.3 mm or more, nonbonds with a height of 0.15 mm or more, and the displacement of the weld relative to the joint. (7 refs.)

68742 Analytical method of solving one class of nonlinear problems in electromagnetic inspection of ferromagnetic products. A.N.Plakhotnyuk, A.S.Trofimov (Krasnoyarsk Polytech. Inst., Krasnoyarsk, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.604-12 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.29-39 (Aug. 1982). [received: April 1983]
An approximate analytical method is proposed for solving one-dimensional (in space) nonlinear problems of electromagnetic inspection which uses data on the boundary conditions, taking also into account electrical conductivity and hysteresis in the ferromagnetic object. The effectiveness of this method is demonstrated by a comparison of theoretical and experimental data on steady periodic magnetization of a strip (cylinder) in a strong longitudinal magnetic field. The oscillatory character of higher harmonics of the electric field intensity at the surface of such an object is also discussed. (20 refs.)

68743 Magnetoelastoacoustic method of nondestructive inspection of heat-treatment quality for steels. L.S.Pravdin (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.629-32 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.57-61 (Aug. 1982). [received: April 1983]
The dependence of the alternating magnetoelastic induction on the hardness of steel is examined on the basis of specimens of grades 20, 35, 45, U8, 30KhGS, 40Kh, 45KhNMF, and KhVG steel which have been heat treated over a wide range of tempering temperatures. This relation is found to be unambiguous for all grades of steel. For ensuring a high sensitivity over a wide range of hardness variation, it is proposed that measurements be made at two levels of magnetic field intensity. Tests performed on commercial production samples, for certification of this method, have yielded a higher than 0.9 çoefficient of correlation between measured signal and hardness. (7 refs.)

68744 Visualization of the results of flaw detection on a color-television screen. V.S.Kozlov, N.I.Kuznetsov, Yu.Sh.Golant (Belorussian Polytech. Inst., Belorussian SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.633-40 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.61-9 (Aug. 1982). [received: April 1983]
Color video-control devices of special construction can be used in nondestructive testing, X-ray analysis, medicine, and wherever radio-control devices with black and white pictures are employed at the present time. The authors derive the equations for colorimetric calculations, which may find an important place in color video-control devices and television handbooks. Theoretical aspects of the coloring of a black and white picture are considered. A color-signal generator is developed and constructed which is an attachment to a color television set, and enables the black and white image to be colored to provide greater contrast for discerning it with a quantitative estimate of its level. In effect, a 'three-dimensional oscilloscope' is produced where the third measurement is represented by the color. New principles are employed in the construction which differ from those described in the literature. For example, the problem of eliminating color frames in the image (called false color tones) is solved in an original manner. (6 refs.)

68745 Alternating magnetization modes in the quality control of hardened and tempered articles from the value of the residual magnetic induction. M.N.Mikheev, G.V.Bida, T.P.Tsar'kova, V.N.Kostin (Inst. of Metal Phys., Acad. of Sci., USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.641-50 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.69-79 (Aug. 1982). [received: April 1983]
Alternating magnetization modes up to certain values of the induction and the same external magnetic field, used in the quality control of tempering from the value of the residual induction B_d of the article, are considered. In the case of an open magnetic circuit a relation is given which connects the value of B_d with the magnetic characteristics of the material, the shape factor, and the external alternating magnetizing field. For a closed circuit of the attached electromagnet an expression is obtained relating the value of the output signal I_{ro} proportional to B_d, and the parameters of the magnetic circuit and the characteristics of the material. The variation of the magnetic properties with tempering temperature, defining the relations $B_d(T_t)$ and $I_{ro}(T_t)$ is investigated for a number of grades of steel. (17 refs.)

68746 Magnetic inspection of the mechanical properties of steel pipes. O.S.Konovalov, A.S.Golovko, V.I.Roitman (Nikopol'sk Southern Pipe Plant, USSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.654-6 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.82-4 (Aug. 1982). [received: April 1983]
The magnetic inspection of the mechanical properties of steel compoennts, especially pipes, is based on the correlation between the magnetic and mechanical parameters of the material of the components. Devices measuring one characteristic (coercive force H_c or remanent magnetic flux density Br) are used in most cases. The ferroprobe coercive force meters KIFM-1, KF-1, or similar devices in which the measuring signal is represented by demagnetizing current I_d, are used most extensively. (3 refs.)

68747 Classification of defects in welded joints on the basis of radiometric inspection results. A.A.Adamenko, V.G.Demidko (E.O. Paton Welding Inst., Acad. of Sci., Kiev, Ukrainian SSR).
Sov. J. Nondestr. Test. (USA), vol.18, no.8, p.664-6 (Aug. 1982). Translation of: *Defektoskopiya (USSR)*, vol.18, no.8, p.93-4 (Aug. 1982). [received: April 1983]
The analytical equations for the output signal of a square radiometric detector are derived in relation to the parameters which charcterize the degree of defectiveness of the welded joint. An algorithm for classification of welded joints on the basis of COMECON standards using the results of radiometric inspection is proposed. (7 refs.)

68748 A large-scale impact spalling test. R.Blickensderfer, J.H.Tylczak (Albany Res. Center, Bur. of Mines, US Dept. of the Interior, Albany, OR, USA).
Wear (Switzerland), vol.84, no.3, p.361-73 (1 Feb. 1983).
A unique test apparatus is described that effectively produces spalling on wear-resistant alloys and can be used to study the causes of spalling. The work was conducted as part of an effort to minimize the consumption of strategic materials used during the mining and processing of minerals. The test utilizes balls 75 mm in diameter made of the test alloys, which are dropped a distance of 3.5 m. Multiple impacts over a range of energy are produced between the balls. The unique design of the test apparatus provides a multiplying effect that results in 30000 or more total impacts per hour on 20 or so test alloys. The four major types of failure that were observed on 22 commercial and experimental alloys that received up to 300000 impacts are discussed. (6 refs.)

68749 Calculational principles for the analysis of ODF reproducibility from pole figures. J.Pospiech (Inst. for Metal Res., Polish Acad. of Sci., Krakow, Poland).
Z. Metallkd. (Germany), vol.74, no.4, p.221-5 (April 1983).
A formalism for the analysis of the reproducibility of the orientation distribution function (ODF) from pole figures has been derived. This formalism is general and it specifies the conditions which any reproduction method should satisfy. Basing on the obtained results the known calculation methods are discussed. (17 refs.)

68750 Impact testing of fibre reinforced composite materials. J.Harding, L.M.Welsh.
Report OUEL-1415/82, Univ. Oxford, England (1982), 18 pp.
Techniques for determining the mechanical properties of composite materials under tensile impact loading are briefly reviewed and the difficulties encountered are discussed. A new method, based on the standard tensile version of the slit Hopkinson's pressure bar (SHPB) apparatus, is described and the validity of data obtained by this means is established. Dynamic stress-strain curves for unidirectionally reinforced CFRP are presented and compared with those determined at lower rates. The limitations of the testing technique are discussed. (15 refs.)

68751 Defect sizing using the Time of Flight Technique on the RNL RSV plate. L.N.J.Poulter, A.Rogerson.
Report NR-R-790(R), UKAEA, Risley, Lancs., England (Dec. 1982), 24 pp. Available from HMSO, London, England.
An ultrasonic inspection system employing the time of flight technique (TOFT) has been developed at RNL for sizing defects in thick section clad plate. Three dimensional defect sizing is achieved through SAFT processing of TOFT data gathered in two orthogonal scans over the identified defect. A description is given of the complete system including data display facilities and analysis procedures. Results of the application of the system to twenty defects in the RNL RSV plate are discussed in terms of the influence of various factors which could influence sizing accuracy. (11 refs.)

Meeting on Electrochemical Techniques in Corrosion Testing and Research ..... See Entry 64576

8. MPA-Seminar. Fracture Behaviour and Nondestructive Testing. Safety of the Pressure Boundary of Light Water Reactors. Materials for Advanced Reactor Systems ..... See Entry 64588

Ultrasonic-resonance method of determining transverse dimensions for fine fibers and wires ..... See Entry 64886

Measuring procedure for transverse dimensions of fine rods and wires by the ultrasonic-resonance method ..... See Entry 64887

A radioisotope method of thickness measurement for rhodium plating on rings ..... See Entry 64888

Accuracy of semiautomatic measurements on digitizing equipment ..... See Entry 64891

Determination of the optimum number and disposition of single ferrosonde transducers ..... See Entry 64899

The ferrosonde flaw detector DFP-1 ..... See Entry 64900

Double-pass oblique-incidence interferometer for the inspection of nonoptical surfaces ..... See Entry 64945

Measurement of absorption coefficients of highly transparent solids by emission spectroscopy ..... See Entry 64960

Exposure-time determination in radiography ..... See Entry 65003

Optical probe for steam generator tube dent measurement ..... See Entry 65346

Examination of tube samples 21-46 and 28-45 from the Ginna Nuclear Plant for intergranular attack ..... See Entry 65347

Twenty-six-inch pipe NDE instrument surveillance test ..... See Entry 65348

Nondestructive evaluation program: Progress in 1982 ..... See Entry 65349

Final report on thw UKAEA defect detection trials on test pieces 3 and 4. December 1982 ..... See Entry 65351

UK developments in structural integrity aspects of NDT ..... See Entry 65356

Some aspects of work in the UK relating to PWR structural integrity ..... See Entry 65357

Development of engineered structural barriers for nuclear waste packages ..... See Entry 65396

Coming in close with Minac [nuclear power plant radiography] ..... See Entry 65693

From laboratory to industry [ultrasonic materials testing] ..... See Entry 66434

Characteristics of noise attenuators for use in acoustic emission studies ..... See Entry 66435

Equivalent circuit and input impedance of a piezoelectric transducer with internal losses ..... See Entry 66437

Design of impedance-type ultrasonic lens system on basis of prescribed field distribution in focal plane ..... See Entry 66438

In-plane shear test of thin panels ..... See Entry 66535

Nondestructive residual-stress measurement in a wide-flanged rolled beam by acoustoelasticity ..... See Entry 66538

Temperature dependence of the sound velocity and ultrasonic attenuation in liquid Bi-Ga and Bi-Sn alloys ..... See Entry 67111

Magnetoelastic effect in the excitation of the steel by elastic oscillations ..... See Entry 67989

Microplasticity and strength of Mn-Zn ferrites ..... See Entry 68596

Depassivation of iron by straining and by abrasion: an a.c. impedance study ..... See Entry 68685

Use of thin layer activation techniques to assess mechanical parts wear. A survey of the industrial experience in France ..... See Entry 68834

A constant stress creep testing machine ..... See Entry 69081

81.90 OTHER TOPICS IN MATERIALS SCIENCE

68752 Cold stamping by extrusion. A.G.Ovchinnikov.
Izv. VUZ Mashinostr. (USSR), no.2, p.68-79 (1983). In Russian.
The existing results of theoretical investigations of forging techniques are used as a basis for their further practical application in the development of new techniques of forging by extrusion, using compact and porous materials; the new techniques include active friction forces and superposition of ultrasonic vibrations. The application of the proposed technological process is exemplified by describing cold stamping by extrusion of oil cans. (7 refs.) *Z.F.V.*

82.00 PHYSICAL CHEMISTRY

The steady state and equilibrium assumptions in chemical kinetics ..... See Entry 64634

82.20 CHEMICAL KINETICS

68753 Shape normalization of catalyst pellet. D.J.Miller, H.H.Lee (Dept. of Chem. Engng., Univ. of Florida, Gainesville, FL, USA).
Chem. Eng. Sci. (GB), vol.38, no.3, p.363-6 (1983).
A shape normalization, which is applicable in the entire range of Thiele modulus ϕ, is developed. A shape normalization established here for small ϕ and the shape normalization already established here for large ϕ are used in developing the normalization for all ϕ. This normalization brings the $\eta-\phi$ curves for all pellet shapes to a single curve corresponding to infinite slab geometry for all ϕ. The effectiveness factor for any shape of catalyst is simply the effectiveness factor for an infinite slab when the Thiele modulus for the slab is properly defined in terms of the characteristic pellet length and the reaction kinetics. The shape normalization is shown to give negligible error for any pellet configuration and first order reaction, and is postulated to hold for general kinetics and any pellet configuration, by proper definition of the Thiele modulus. (3 refs.)

68754 Deconvolution of overall kinetic data down to the elementary rate constants for a process with an intermediate. Z.Slanina (J. Heyrovsky Inst. of Phys. Chem. & Electrochem., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.579-83 (22 April 1983).
A fitting technique has been suggested which makes it possible to extract, from overall kinetic data, the rate constants of elementary activation steps in the kinetics of a process involving one intermediate. The treatment has been applied to the boat pathway of the Cope rearrangement of 1,5-hexadiene. (29 refs.)

68755 Diffusion-limited reaction rate theory for two-dimensional systems. D.C.Torney, H.M.McConnell (Stauffer Lab. for Phys. Chem., Stanford Univ., Stanford, CA, USA).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.147-70 (8 May 1983).
The Noyes (1961) and Smoluchowski (1916) diffusion-limited reaction rate theories are proved to be equivalent on a lattice. The Noyes theory is analysed and used to predict the kinetics of the two-dimensional irreversible reaction $A+B \rightarrow P$. Only condensed phase reactions with molecules of A and B undergoing Brownian motion (diffusion) are discussed. For comparison, all calculations are done in both two and three dimensions. The two-dimensional rate function $k_N(t)$ in the equation $d[A]/dt=d[B]/dt=-k_N(t)[A][B]$ asymptotically goes to zero as $(\ln t)^{-1}$ as t increases; the asymptotic expansion of $k_N(t)$ is derived from the expansion for the first-return probability in a random walk on a square lattice. The theoretical rate function is determined as a function of the probability α of reaction given an encounter. Although $k_N(t)$ is not significantly different from 'empirical' rate functions in a Monte Carlo simulation of a two-dimensional chemical reaction, it does differ from the rate function in a two-dimensional fluorescence quenching experiment. (36 refs.)

68756 Bifurcation pattern in reaction-diffusion dissipative systems. R.Janssen, V.Hlavacek, P.van Rompay (Dept. of Chem. Engng., Katholieke Univ. Leuven, Leuven, Belgium).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.487-92 (April 1983).
A detailed bifurcation analysis of the reaction-diffusion equations representing the trimolecular model of Prigogine and Lefever ('Brusselator') is performed. The model considers also the diffusion of the initial component. The homogeneous solution to the problem cannot exist and the bifurcation analysis must be performed numerically. There are two ways of possible branching, either the basic branch will be followed or branching from an isolated branch may occur. In both cases, the branching is of the type symmetric→asymmetric→symmetric, etc. For higher dimension of the system a topologically interesting isolated branch of asymmetric solutions was discovered. (15 refs.)

Substituent effects on benzyl radical ESR hyperfine coupling constants. The $\sigma\alpha^{\cdot}$ scale based upon spin delocalization ..... See Entry 68767

Electronic energy partitioning in reactions occurring on more than one potential energy surface: metastable $Mg(^3P)$ atoms with halogen molecules ..... See Entry 68771

Dynamics of hydrogen atom and proton transfer reactions. Nearly degenerate asymmetric case ..... See Entry 68772

Formation of BrO_2 in the Belousov-Zhabotinsky system reaction of aliphatic alcohols with bromate ..... See Entry 68775

Quantitative treatment of micellar effects upon the nucleophilicity of halide ions ..... See Entry 68798

Radiative association and the synthesis of long carbon chain molecules in interstellar clouds ..... See Entry 69697

82.20K Potential energy surfaces for chemical reactions

(see also 31.70F -in atomic and molecular physics, 34.20 Intermolecular forces, 34.50L Atomic and molecular beam studies)

An ab initio study of the reaction $Be(^3P)+H_2(^1\Sigma_g^+) \rightarrow BeH(^2\Sigma^+)+H(^2S)$ ..... See Entry 68768

Atom-molecule reactive scattering and symmetrized cross section for the system containing identical nuclei ..... See Entry 68770

Electronic energy partitioning in reactions occurring on more than one potential energy surface: metastable $Mg(^3P)$ atoms with halogen molecules ..... See Entry 68771

Single and triplet energy surfaces of NiH_2 ..... See Entry 68773

82.20M Nonequilibrium kinetics

Formation of BrO_2 in the Belousov-Zhabotinsky system reaction of aliphatic alcohols with bromate ..... See Entry 68775

82.20R Energy distribution and transfer, relaxation

(see also 31.70H Time-dependent phenomena in atomic and molecular physics)

Electronic energy partitioning in reactions occurring on more than one potential energy surface: metastable $Mg(^3P)$ atoms with halogen molecules ..... See Entry 68771

82.30 SPECIFIC CHEMICAL REACTIONS; REACTION MECHANISMS

68757 The active role of the solvent in chemical reactivity. J.Bertran (Dept. de Quimica Fisica, Facultad de Quimica, Sevilla, Spain).
THEOCHEM (Netherlands), vol.10, p.129-38 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Nucleophile-electrophile combination reactions, hydrolytic reactions, intramolecular hydrogen shifts and some reactions in which the solvent relaxation plays an important role are studied in order to demonstrate the active role of the solvent. The equilibrium or nonequilibrium of transition state solvation are examined in light of the solvent's active role. (57 refs.)

68758 Macrocyclic receptor chemistry: experimental and theoretical studies on molecular recognition. G.Wipff (Inst. de Chimie, Strasbourg, France), P.A.Kollman, J.M.Lehn.
THEOCHEM (Netherlands), vol.10, p.153-65 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Synthetic macrocyclic receptors containing an intramolecular cavity ('crypt') display remarkable binding properties towards a variety of charged substrates (spherical cations and anions, small molecules, functionalized chains, complexes, etc...) and provide elements for an analysis of the factors involved in the 'lock and key' substrate $\subset$ receptor complementarity within the 'cryptate' inclusion complex formed. Empirical (molecular mechanics) calculations on a typical macrocycle (18-crown-6) and its alkali complexes account for several aspects of spherical recognition (flexibility of the ligand, weak hydrophilicity of the complexed cation, binding specificity, and the 'macrocyclic effect') and give insight into conformational dependent energies of the ligand, a factor not otherwise available. The relative energies of various conformations of a macrobicyclic cryptand have also been investigated. (34 refs.)

68759 Dynamic representation of quantum chemical results using computer graphics: molecular rearrangements, art or science?. J.Weber, M.Roch, J.-J.Combremont (Lab. of Computational Chem., Univ. of Geneva, Geneva, Switzerland), P.Vogel, P.A.Carrupt.
THEOCHEM (Netherlands), vol.10, p.189-200 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
An interactive computer graphics equipment is used as an output device for representing the results of quantum chemical calculations. The advantages of such displays are illustrated by the description of several applications: (i) interactive visualization of molecular properties and (ii) dynamic representation of unimolecular rearrangements. Several examples are chosen among the latter group of applications: reversible formation of cyclobutanes from 1,3-butadiene, intramolecular migration of a methyl group over an allyl substrate, and pseudo-rotation of a seven-membered heterocyclic compound. It is shown that the 3D representation of reaction paths is generally an involved task since, as the geometrical data base is most often incomplete, it is necessary to find a middle ground between chemically reasonable and aesthetically pleasant pictures, thus leading to a technique which lies somewhere in between art and science. (23 refs.)

68760 A theoretical study of the solvent effect on dissociation reactions. The role of the first solvation shell. P.Demontis, E.S.Fois, A.Gamba, B.Manunza, G.B.Suffritti (Phys. Chem. Inst., Univ. Sassari, Sassari, Italy), M.Simonetta.
THEOCHEM (Netherlands), vol.10, p.231-43 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
Within a model describing the solvent effect as mainly due to a restricted number of molecules simulating the first solvation shell, a theoretical study of dissociation reactions, performed by LCAO-MO-SCF approximation at CNDO/2 level, is presented. Several solutes in different solvents have been considered, and in particular the results of a study on the dissociation of CH_3F in H_2 are shown in detail. (16 refs.)

68761 Solvation effects in the phototautomerization of 7-quinolinol. P.J.Thistlethwaite (Phys. Chem. Dept., Melbourne Univ., Parkville, Australia).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.509-12 (22 April 1983).
Some aspects of the enol→keto photoautomerization of 7-quinolinol in methanol have been re-examined. The results show that photoautomerization only occurs in suitably solvated enol tautomers. (11 refs.)

68762 Collisional dissociation of $CH_3O_2^+$. H.Villinger, A.Saxer, R.Richter, W.Lindinger (Inst. fur Experimentalphys., Abteilung Atom- und Molekulphys., Innsbruck, Austria).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.513-16 (22 April 1983).
The collision-induced breakup of $CH_3O_2^+$ ions, produced in various binary ion-neutral reactions, was investigated in a drift experiment in the energy range from 0.2 to 1.2 eV. The products observed were HCO^+ (50%) and H_3O^+ (50%), independent of the collision energy inducing the breakup. The energy barrier for the breakup is 22 ± 6 kcal/mole. (14 refs.)

68763 Conjecture about diffusion-controlled reactions of the solvated electron in alkanols. Farhataziz (Chem. Dept., Texas Woman's Univ., Denton, TX, USA), Riazuddin.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1642-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The solvated electron e_s^-, in alkanols is considered to have a physical zone of volume, V_p, and this volume is surrounded by an inactive zone of volume, V_I, which contains the hydrocarbon parts of the alkanol molecules responsible for solvating the electron. In a diffusion controlled reaction of e_s^- with a neutral species, the neutral species reaches the outer boundary of V_I by the Stokes-Einstein mutual diffusion process. However, neutral species must advance inside V_I before the reaction is completed. Making certain assumptions, the nature of the movement of the neutral species inside V_I and the reaction probabilities at various points inside V_I have been examined, and appropriate mathematical formulation has been developed. A comparison of the computed and experimental results, for the diffusion-controlled reactions of e_s^- with phenanthrene in C_1 to C_{10} 1-alkanols, suggests that the product of the diffusion coefficient of phenanthrene and the reaction probability decreases exponentially with increasing total volume of e_s^-. (13 refs.)

68764 First order decay of the solvated electrons in 1-alkanols at 25°C. Farhataziz, S.Kalachandra (Dept. of Chem., Texas Woman's Univ., Denton, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1645-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Specific rates, in units of $10^4 s^{-1}$, for the pseudo-first order reactions of the solvated electron with its solvents for C_1 to C_{10} 1-alkanols measured by pulse radiolysis at 25°C are given in parentheses after the names of 1-alkanols: methanol and ethanol (10), 1-propanol (6), 1-butanol to 1-octanol (5), 1-nonanol (6), and 1-decanol (≤ 16). These specific rates are discussed in terms of the viscosities of the solvents, radii and masses of the solvated electrons and energies of activation of the reactions. (11 refs.)

68765 Vapor pressure in the dissociation of rhenium disulfide as a function of the composition of the compound. L.E.Ugryumova, R.A.Isakova, V.A.Snurnikova (Inst. of Metal. & Enrichment, Acad. of Sci., Kazakh SSR).
Inorg. Mater. (USA), vol.18, no.6, p.813-16 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.969-72 (June 1982). [received: Feb. 1983]
In a measurement of the vapor pressure by the dew point method the region of homogeneity of rhenium disulfide in the temperature range 873-1473K was determined. The composition of rhenium disulfide with respect to sulfur within the limits of the region of homogeneity varies from 25.3 to 29% by weight. The influence of nonstoichiometry on the vapor pressure in the case of dissociation of rhenium disulfide was demonstrated. Thus, at 873-1473K the vapor pressure of sulfur above alloys belonging to the limit of the region of homogeneity on the sulfur side reaches $(5\text{-}25.3).10^5$ Pa, and at the opposite limit on the metal side in the corresponding temperature range it is lowered to $1.10^{-1}\text{-}5.10^2$ Pa. (15 refs.)

68766 Mechanism of pyrolysis of monosilane at reduced pressure. M.S.Sukhov.
Inorg. Mater. (USA), vol.18, no.7, p.913-18 (July 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.7, p.1077-82 (July 1982). [received: Feb. 1983]
It has been shown that at reduced pressure the pyrolysis of SiH_4 proceeds by two mechanisms with different limiting stages. The activation energies for the heterogeneous and gas phase decomposition were determined as 1.55 and 2.27 eV, respectively. Models for the gas phase and heterogeneous pyrolysis have been proposed. Kinetic equations have been obtained for the growth rate of layers of polycrystalline silicon. (19 refs.)

68767 Substituent effects on benzyl radical ESR hyperfine coupling constants. The $\sigma\alpha^{\cdot}$ scale based upon spin delocalization. J.M.Dust, D.R.Arnold (Dept. of Chem., Dalhousie Univ., Halifax, Nova Scotia, Canada).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1221-7 (9 March 1983).
The electron spin resonance spectra of 21 para- and meta-substituted benzyl radicals have been analyzed. A substituent constant, $\sigma\alpha^{\cdot}$, has been defined from the benzylic α-hydrogen hyperfine coupling constant. The $\sigma\alpha^{\cdot}$ constant reflects the component of energy that may be attributed to spin delocalization in a substituted benzyl radical in comparison to the unsubstituted radical. For the derivatives studied, para substitution is stabilizing, except when fluorine is the substituent; meta substitution destablizes the benzyl radical. A series of radical reactions is reexamined with an extended Hammett relation. The relative importance of spin delocalization vs. polar effects is assessed by the ratio of $\rho^{\cdot}$ to ρ. The importance of choosing substituents for which $\sigma\alpha^{\cdot}$ and σ differ widely for such an assessment is emphasized. (52 refs.)

68768 An ab initio study of the reaction $Be(^3P)+H_2(^1\Sigma_g^+) \rightarrow BeH(^2\Sigma^+)+H(^2S)$. R.A.Poirier, M.R.Peterson, M.Menzinger (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.7, p.4592-6 (1 April 1983).
The lowest triplet potential energy surface for the reaction of metastable $Be(^3P)$ with H_2 has been studied by ab initio SCF-MO and CI calculations. The stationary points along the reaction coordinate were obtained by automatic gradient optimization. Broadside (C_{2v}) attack is found to be favored over the collinear $C_{\infty v}$ approach and a stable intermediate of C_{2v} symmetry is found for $^3BeH_2$. The authors discuss experimental implications for the dynamics of this interesting exothermic process. (29 refs.)

68769 Polarization model for NH_3-H-H_2O proton transfer reaction. C.W.David (Dept. of Chem., Univ. of Connecticut, Storrs, CT, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5268-9 (15 April 1983).
The polarization model for water was extended to ammonia and its polymers up to and including the hexamer. Haymet and Oxtoby (1982) have recently criticized the polarization model as lacking in theoretical foundation, especially in the intermediate internuclear separation domain. With the appearance of the study by Scheiner (1982) in which the proton transfer reaction between ammonia and water is studied with great accuracy, it becomes possible to test the polarization model accuracy exactly in the domain of distances in which Oxtoby has claimed that the polarization model fails. The authors report the polarization model results, comparable to those of Scheiner, which do indeed indicate the poor agreement with ab initio computations. (5 refs.)

68770 Atom-molecule reactive scattering and symmetrized cross section for the system containing identical nuclei. B.H.Choi, R.T.Poe, J.C.Sun, K.T.Tang (Dept. of Phys., Univ. of California, Riverside, CA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5590-605 (1 May 1983).
A formulation of atom-diatomic molecule (or molecular ion) collision on a single potential surface of ground electronic state of triatomic (or ionic) system containing identical nuclei is presented based on the formal multiarrangement channel collision theory. A properly symmetrized scattering matrix which is unitary over all arrangement channels is introduced. The matrix makes the formulation quite systematic. Furthermore, it enables one to extend the formulation efficiently to more general collision systems containing several species of the identical particles by partitioning the arrangement channels into collections of the indistinguishable ones. This is illustrated in the simple three particle atom-diatom system of the present work. Through the matrix, formulas of the optical theorem satisfied by the symmetrized cross sections are also obtained. The adiabatic electronic wave functions are found to be either symmetric or antisymmetric under interchange of nuclear coordinates. It is determined by the electronic states but is independent of the fermion or boson characteristic of the nuclear spin. Formulas of the properly symmetrized cross sections that arise from the nuclear spin statistics of the indistinguishable nuclei are obtained for the symmetric as well as the antisymmetric electronic wave function of the triatomic system. They are obtained in terms of either resultant nuclear spins of the molecules or individual nuclear spin quantum numbers. Depending on the interchange symmetries of the electronic wave functions with respect to nuclear coordinates, the observable cross sections of the reaction for indistinguishable nuclei result in quite different characteristics as manifested, for example, in the principle of detailed balance. When the scattering takes place through direct and exchange collisions coherently, either resultant nuclear spin conversion or rotational parity conversion between initial and final molecules is an indication that the reaction has taken place via exchange scattering for certain types of collisions. For other types of collisions, only the resultant spin conversion is possible in the reactive (exchange) scattering. (54 refs.)

68771 Electronic energy partitioning in reactions occurring on more than one potential energy surface: metastable $Mg(^3P)$ atoms with halogen molecules. A.Kowalski, M.Menzinger (Dept. of Chem., Univ. of Toronto, Toronto, Ontario, Canada).
J. Chem. Phys. (USA), vol.78, no.9, p.5612-20 (1 May 1983).
For the reactions metastable $Mg(^3P)$ atoms and dihalogen molecules F_2, Cl_2, and Br_2, the authors have measured by a beam-gas experiment the absolute cross sections for all three electronic reaction channels: formation of $MgX(X^2\Sigma^+)$ ground state, $MgX(\tilde{A}^2\Pi)$ chemiluminescent products and $MgX^+(^1\Sigma^+)$ chemi-ions. The chemiluminescence and chemi-ion yields both turn out to be of the order of 1% in all three systems. By qualitative MO theory, it is shown that the dynamical bottleneck in the adiabatic chemiluminescence channel is an early barrier and in the diabatic chemi-ionization process a spin flip occurring during the approach phase, following a long-range electron transfer. An information theoretic analysis reveals considerable dynamic bias associated with most of the CL and CI products [except for $MgCl(A^2\Pi)$], and the surprisal plots are nonlinear for all three reactions. (33 refs.)

68772 Dynamics of hydrogen atom and proton transfer reactions. Nearly degenerate asymmetric case. V.K.Babamov (Centro de Graduados, Inst. Tecnologico de Tijuana, Tijuana, Mexico), V.Lopez, R.A.Marcus.
J. Chem. Phys. (USA), vol.78, no.9, p.5621-8 (1 May 1983).
A method for approximate treatment of collinear H atom or proton transfer reactions $AH+B \rightarrow A+HB$ which involve two nearly degenerate vibrational states is developed. The method is based on constructing a diabatic representation of the problem, i.e., one in which the reactant and the product vibrational states are distinguished as such throughout the collision. The diabatic representation is constructed with the aid of the adiabatic one discussed in an earlier paper. The treatment can also be applied to asymmetric exchange reactions in which case it yields good agreement with other results. (21 refs.)

68773 Single and triplet energy surfaces of NiH_2. M.R.A.Blomberg, P.E.M.Siegbahn (Inst. of Theoretical Phys., Univ. of Stockholm, Stockholm, Sweden).
J. Chem. Phys. (USA), vol.78, no.9, p.5682-92 (1 May 1983).
Contracted CI calculations have been performed for the concerted dissociation of NiH_2 into Ni and H_2. All low-lying states have been considered. The most important result of the calculations is that the $^1A_1$ state is much lower in energy than the other states for bent geometries. This state even forms a slightly stable complex with an H-Ni-H angle of 49°. The binding is between Ni *sd*-hybridized orbitals and a weakened H_2 molecule. The ground state of NiH_2 is, however, found to be a linear $^3\Delta_g$ state, with the lowest singlet almost 1.5 eV higher in energy at this geometry. The forbidden dissociation reactions for the triplets and singlets with the lowest barriers proceed in steps with the occupation of each symmetry changing by only one unit in each step. The lowest triplet barrier is 1.8 eV, and for this state a concerted dissociation is slightly preferred over a stepwise loss of a hydrogen at a time. The mechanism for the concerted triplet dissociation may also be through spin-orbit coupling to the $^1A_1$ state, since the states cross. The correlation effects on the potential energy surfaces of NiH_2 are further shown to be of qualitative importance. (31 refs.)

68774 R.F. plasma reactions in light hydrocarbons: effect of the input power on the decomposition of ethane. P.Canepa, G.Castello, M.Nicchia, S.Munari (Istituto di Chimica Industrial, Univ. di Genova, Genova, Italy).
Radiat. Phys. & Chem. (GB), vol.21, no.4, p.381-7 (1983).
The effect of the input power on the plasma decomposition of ethane in an inductively coupled radiofrequency glow discharge was studied with a static system at a constant initial pressure of 0.5 torr, with specific energy E_s, up to 2×10^6 Jg^{-1}. Input power values of 25, 50 and 100 W were used. The gaseous products were analyzed by gas chromatography. The effect of power input change was found to be smaller than the previously studied influence of the initial pressure variation. The yields of C_2H_4 and C_2H_2 slightly increases with increasing W, while the yield of CH_4 shows a greater variation. The yield of C_3H_8 decreases with increasing W and other heavy products do not show appreciable change. The yield of the crosslinked polymethylene formed as solid product slightly increases and its H/C ratio (about 1.5) slightly decreases with increasing *W*. (16 refs.)

68775 Formation of BrO_2 in the Belousov-Zhabotinsky system reaction of aliphatic alcohols with bromate. H.D.Forsterling, H.J.Lambertz, H.Schreiber (Fachbereich Phys. Chem., Philipps-Univ., Marburg, Germany).
Z. Naturforsch. a (Germany), vol.38A, no.4, p.483-6 (April 1983).
BrO_2 was found as an intermediate in the reaction of bromate with alcohols (e.g. methanol, isopropanol, allylalcohol) or ketones (e.g. acetone). This reaction may be important for the understanding of bromate driven oscillators. (12 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ... See Entry 64573

The steady state and equilibrium assumptions in chemical kinetics ... See Entry 64634

Magnetic field effect measurements by time-selective absorption sampling ... See Entry 64921

Atomic physics of negative ions: a report on the US-Mexico joint workshop ... See Entry 65848

Theoretical study of electrolytic ring opening of oxirane ... See Entry 65886

Dynamics of the spectra of solvating systems ... See Entry 65909

Observation by laser ionization spectroscopy of vibrationally excited nitric oxide following $O(^1D_2)+N_2O \rightarrow 2NO$ ... See Entry 66004

Complexes of a stable nitroxyl radical with hydroxyl-containing molecules in frozen solutions ... See Entry 66035

Temperature dependence of intermolecular vibrational energy transfer in the two-channel cyclopropane-1,1-d_2 system. Neon bath gas ... See Entry 66103

Model calculation of the intrinsic barrier for proton transfer in a carbon acid ... See Entry 66122

Comments on the molecular complexes of aromatic amines with dinitrobenzenes ... See Entry 66125

Measurements of the dissociative recombination coefficients of O_2^+, NO^+ and NH_4^+ in the temperature range 200-600K ... See Entry 66135

Thermal stability and crystal structure of the double molybdate $Li_7Ho_3(MoO_4)_8$ ... See Entry 66964

Ionic conductivity of Li_2O-$(LiCl)_2$-B_2O_3-Al_2O_3 glasses ... See Entry 67280

Composition, structure, and properties of pyrolytic iron oxide films ... See Entry 67390

Spatial dispersion of dielectric permittivity in the theory of solvated electrons and F centers ... See Entry 68110

Decomposition products of silicone liquid due to electric discharge ... See Entry 68126

Luminescence of products of low-temperature pyrolysis of anthracene ... See Entry 68288

EELS identification of the adsorbed species from acetone adsorption on Pt(111) ... See Entry 68376

Comment on 'Molecule formation during sputtering by two-body associative ionization with diabatic curve crossing ... See Entry 68390

Regulation of mass transfer in a zinc selenide-hydrogen-inert gas transport system ... See Entry 68414

Composition control in proton-exchanged $LiNbO_3$ ... See Entry 68421

Carbon fibers produced by pyrolysis of natural gas in stainless steel tubes ... See Entry 68464

Deconvolution of overall kinetic data down to the elementary rate constants for a process with an intermediate ... See Entry 68754

Calorimetrical investigation of the interaction between stannic tetrachloride and diethyl ether in nitrobenzol and 1,2-dichloroethane solutions ... See Entry 68792

Magnetocatalytic effect on rare earth oxides ... See Entry 68795

Quantitative treatment of micellar effects upon the nucleophilicity of halide ions ... See Entry 68798

Micellar effects upon dephosphorylation in water and aqueous 1,2-diols ... See Entry 68799

Esters dissociatively adsorb on alumina ... See Entry 68802

Compositional characterization of microwave plasma a-Si:H films ... See Entry 68817

Molecular orbital study of the protonation of DNA bases ... See Entry 68921

Radiative association and the synthesis of long carbon chain molecules in interstellar clouds ... See Entry 69697

82.35 POLYMER REACTIONS AND POLYMERIZATION

68776 A simple model of the polymerisation process. H.N.V.Temperley (Dept. of Appl. Math., Univ. Coll. of Swansea, Swansea, Wales).
J. Phys. A (GB), vol.16, no.6, p.1241-5 (21 April 1983).
The monomer is taken to be a fluid with purely repulsive interactions, which is treated by the Mayer theory. Some of the repulsions between pairs of monomer molecules are modified to become strong attractions by the assumed polymerising agent; and the gelation point is taken to be determined by the pressure passing through a maximum with increasing density. If the repulsions are taken to be Gaussian, detailed calculations can be made and it is found that the position of the gel point is little affected by correlations between the pairs of molecules whose interactions are modified. (4 refs.)

68777 Polymerization of 16-heptadecenoic acid monolayers. K.C.O'Brien, C.E.Rogers, J.B.Lando (Dept. of Macromolecular Sci., Case Western Reserve Univ., Cleveland, OH, USA).
Thin Solid Films (Switzerland), vol.102, no.2, p.131-40 (15 April 1983).
Monolayers of heptadecenoic acid (vinyl acid) were spread at a gas-water interface. The terminal double bond of the vinyl acid enabled it to be polymerized on exposure to UV radiation. Pressure-area isotherms for both monomer and polymer vinyl acid were then recorded and compared with isotherms from similar compounds. Preliminary studies were conducted to minimize the degree of dissolution of the fatty acid. The polymerization kinetics were examined by the use of UV spectroscopy and measurements of the reduction in the area occupied by the film at a constant surface pressure. The reaction appeared to follow zero-order kinetics after an initial acceleration period. The rate constant for the reaction increased with increasing surface pressure. A dynamic mechanical test was performed to determine the mechanical properties of monolayers at the gas-water interface. Films were polymerized to various conversions and then examined to determine the relation between mechanical properties and conversion. A simple model is proposed to correlate the monolayer's structure and the dynamic mechanical data. (14 refs.)

Molecular orbital theory of chain propagation in free-radical addition polymerization of vinyl monomers ... See Entry 65877

Statistics of 'starburst' polymers ... See Entry 66899

Comparative studies between monomeric and polymeric sodium 10-undecenoate micelles ... See Entry 68807

Computer simulation of a model for irreversible gelation ... See Entry 68809

82.40 CHEMICAL KINETICS AND REACTIONS: SPECIAL REGIMES

68778 Spatially resolved temperature measurements in a flame using laser-excited two-line automatic fluorescence and diode-array detection. M.Alden, P.Grafstrom, H.Lundberg, S.Svanberg (Dept. of Phys., Lund Inst. of Technol., Lund, Sweden).
Opt. Lett. (USA), vol.8, no.5, p.241-3 (May 1983).
Spatially resolved temperature measurements in a CH_4-air flame have been achieved using two-line laser-induced fluorescence from indium atoms seeded to the flame. (16 refs.)

68779 Instantaneous Ramanography of a turbulent diffusion flame. M.B.Long, C.Fourguette, M.C.Escoda (Dept. of Mech. Engng., Yale Univ., New Haven, CT, USA), Clyde B. Layne.
Opt. Lett. (USA), vol.8, no.5, p.244-6 (May 1983).
The first reported instantaneous two-dimensional map of the fuel-gas concentration in a turbulent diffusion flame using quantitative Ramanography is described. Details of the experimental configuration are presented, along with data obtained in both cold flows and turbulent reacting flows. (12 refs.)

Characteristics of PWR ice condenser containment during degraded core and full core meltdown accidents ... See Entry 65622

The multi-compartment-code 'WAVCO', developed to analyse the behaviour of non-condensables during hypothetical accidents ... See Entry 65627

Failure modes of a concrete nuclear containment building subjected to hydrogen detonation ... See Entry 65631

Analysis of the Three Mile Island (TMI-2) hydrogen burn ... See Entry 65639

Detonability of containment building atmospheres during core-meltdown accidents ... See Entry 65640

Hydrogen combustion in aqueous foams ... See Entry 65641

Development and applications of a computer program for modelling the response to hydrogen burns in containment ... See Entry 65643

Combustion of hydrogen at high concentrations including the effect of obstacles ... See Entry 65644

Hydrogen combustion results from the Sandia intermediate-scale (VGES) tank and the Sandia critical-tube-diameter test facility ... See Entry 65645

A simplified hydrodynamic model of hydrogen flame propagation in reactor vessels ... See Entry 65646

Numerical optimization studies of axisymmetric unsteady sprays ... See Entry 66617

Operator splitting methods for the computation of reacting flows ... See Entry 66648

Coherent anti-Stokes Raman spectroscopy of water vapor of combustion diagnostics ... See Entry 66670

A rocket observation of the 6300 Å/5200 Å intensity ratio in the dayside aurora: implications for the production of $O(^1D)$ via the reaction $N(^2D)+O_2 \rightarrow NO+O(^1D)$ ... See Entry 69401

82.40T Chemiluminescence and chemical laser kinetics

(see also 42.55K Chemical lasers, 78.60P Chemiluminescence)

Thermodynamic treatment of chemiluminescence efficiency ..... See Entry 68337

Electronic energy partitioning in reactions occurring on more than one potential energy surface: metastable Mg(^3P) atoms with halogen molecules ..... See Entry 68771

82.45 ELECTROCHEMISTRY AND ELECTROPHORESIS

(see also 66.10 Ionic conduction in liquids; for electro-osmosis, see 82.65)

68780 The effect of bubbles attached to an electrode on electrical resistance and dissolved gas concentration. S.D.R.Wilson, A.Hulme (Dept. of Math., Univ. of Manchester, Manchester, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.133-46 (8 May 1983).
When a process of electrolysis results in the evolution of gas, the gas forms bubbles at nucleation sites on one or both electrodes. These bubbles grow and eventually detach themselves. It is important to know what effect the bubbles will have on the voltage of the electrolytic cell because of the high cost of electrical power. Although the free bubbles have been much studied, the attached bubbles have not. Here the additional resistance due to the attached bubbles is calculated by means of an asymptotic method which is valid (roughly speaking) when the bubbles are widely spaced and the mean spacing is small compared with the inter-electrode gap. A similar method is used to calculate the degree of supersaturation of the dissolved gas; this is of interest because it influences the reversible voltage of the cell. (11 refs.)

68781 Activity coefficients of electrolytes. J.N.Nanda (Panjab Univ., Chandigarh, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.584-8 (Nov. 1982). [received: April 1983]
The ion lattice concept is extended to the solution of electrolytes. It is shown that the experimental values of activity coefficients of dilute solutions conform more to the cube root law than to the square root law. At high concentration there is the opposite effect of ion compression which should be calculated separately. An empirical constant may explain the experimental curves for various electrolytes. (6 refs.)

68782 Digital simulation of transient isoelectric focusing. A.Graham, O.A.Palusinski, R.A.Mosher, M.Bier (Biophys. Technol. Lab., Univ. of Arizona, Tucson, AZ, USA), D.A.Saville.
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.92-4 vol.4
The results of a digital simulation of the transient evolution of an isoelectric focusing (IEF) system are presented. The simulation employed a recently developed comprehensive mathematical model of IEF processes. The nonlinear parabolic equations of the general theory are given for the simulated system. The numerical technique applied and the data from a sample computation are discussed. (7 refs.)

Infrared spectrum of CO adsorbed on a platinum electrode ..... See Entry 65977

Dielectrophoretic motion of bubbles in liquid ..... See Entry 66642

Flow of liquid cathodes in three-dimensional magnetic fields .. See Entry 66646

Stability behaviour of mixed conducting solids after applying electrical potential differences—measurements with point electrodes on Ag_2S and Cu_2S ..... See Entry 67211

Electrochemical study of Ti in bromide melts ..... See Entry 67241

Conductivity of supercooled aqueous potassium chloride solutions to −27°C and 50 MPa ..... See Entry 67250

Effect of ethanol on the conductivity of supercooled aqueous potassium chloride solutions ..... See Entry 67251

Photoelectrochemical study of TiNi alloy oxide layer ..... See Entry 67776

Study of the electrochromic effect in vanadium and tungsten oxides ..... See Entry 68174

Competition among adsorbed species for surface sites on Ag electrodes as determined by SERS ..... See Entry 68236

Crystallographic anisotropies in electrochemical etching of Pt ..... See Entry 68673

Plastic battery ..... See Entry 68863

Water electrolysis for hydrogen production ..... See Entry 68902

82.50 PHOTOCHEMISTRY AND RADIATION CHEMISTRY

(see also 33.50 Fluorescence, phosphorescence; radiationless transitions)

68783 Photochemistry in Van der Waals complexes: observation of the intermediate state of the Hg*, Cl_2 reaction. C.Jouvet, B.Soep (Lab. de Photophys. Moleculaire, Univ. Paris-Sud, Orsay, France).
Chem. Phys. Lett. (Netherlands), vol.96, no.4, p.426-8 (15 April 1983).
A novel method designed to observe the collision complex of a photochemical reaction is reported here. The reactants Hg, Cl_2 are frozen in a Van der Waals complex (Hg-Cl_2), and then promoted by an optical excitation (250 nm) to the reactive state. The broad complex action spectrum, presumably due to the Hg^+-Cl_2^- intermediate, is monitored through the $HgCl(B^2\Sigma^+)$ fluorescence. (7 refs.)

68784 Infrared multiphoton decomposition and energy-dependent adsorption cross sections of chloroethane-d_0, -2-d_1, and -2, 2, 2-d_3. J.S.Francisco, Zhu Qingshi, J.I.Steinfeld (Dept. of Chem., MIT, Cambridge, MA, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5339-50 (1 May 1983).
The infrared photochemistry of chloroethane-d_0, -2-d_1, and -2, 2, 2-d_3 have been investigated. In all cases, the multiple infrared photon induced dissociation is found to proceed by four-center elimination of HCl (or DCl). An energy-grained master equation is used to interpret the data; in this way, the energy-dependent photon absorption cross section $\sigma(E)$ is determined for all three species. The functional form of $\sigma(E)$ approaches that for a 'large' (i.e. high density of states) molecule with increasing deuteration. Ensemble properties, such as vibrational energy distributions and average energy deposition, can then be determined; but these observables do not by themselves suffice to determine a unique form for $\sigma(E)$. A form for $\sigma(E)$ can, however, be specified within certain limits by applying constraints imposed by intramolecular vibrational coupling models. (63 refs.)

68785 Infrared multiphoton decomposition of monosilane sensitized by silicon tetrafluoride. P.A.Longeway, F.W.Lampe (Dept. of Chem., Pennsylvania State Univ., University Park, PA, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.354-8 (20 Jan. 1983).
The decomposition of SiH_4, sensitized by the multiphoton absorption of unfocused infrared laser radiation by SiF_4, has been studied at a fluence of 0.31 J/cm^2 and over a total pressure range of 3-16 torr. In contrast to the direct infrared multiphoton induced decomposition, the only volatile products observed were H_2 and Si_2H_6 which, within experimental error, were formed in equal amounts. It is proposed that collisional energy transfer from vibrationally excited SiF_4 produces internally excited SiH_4 molecules which break down exclusively to SiH_2 and H_2. This is followed by insertion of SiH_2 into SiH_4 to form Si_2H_6. The absence of Si_3H_8 and higher silanes in the volatile products, which is characteristic of other silane decomposition studies, is attributed to the absence of SiH_3 radicals and the fact that the SiH_4 molecules attacked by SiH_2 contain only that excess vibrational energy characteristic of thermal equilibrium at 300K. (29 refs.)

68786 Electron spin resonance of spin-trapped radicals in γ-irradiated aqueous uracil solutions. Chromatographic separation of radicals. K.Makino, M.M.Mossoba, P.Riesz (Nat. Cancer Inst., Nat. Inst. of Health, Bethesda, MD, USA).
J. Phys. Chem. (USA), vol.87, no.6, p.1074-80 (17 March 1983).
Air-saturated aqueous uracil solutions were γ irradiated at room temperature in the presence of 2-methyl-2-nitrosopropane (the spin trap). The resulting radicals were separated subsequently by high-performance liquid chromatography and detected by ESR. With a phosphate buffer (pH 7.0), the spin adduct, NH-C(=O)-NH-C(=O)-CH(-OH)-CH-N(O.)-^{t}Bu (A), was obtained while with a Na_2HPO_4-NaOH buffer (pH 11.0), the spin adduct (B) which has the same chemical structure as (A) but shows a different ESR spectrum from that of (A) was separated. The spin adducts, A and B, were found to be cis-trans isomers of each other. The assignments for these spin adducts were confirmed. In addition to these spin adducts, NH-C(=O)-NH-C(=O)-CH-(-N(O.)-^{t}Bu)-CH-OH (C) was obtained. The ESR spectra of A, B, and C were compared with those obtained from UV-irradiated aqueous dihydrouracil solutions containing MNP and H_2O_2 at various pH values. (29 refs.)

68787 An optimized device for UF_6 laser isotopic photochemistry using an optical parametric oscillator and a down converter. P.Kupecek, J.M.Weulersse, P.Isnard, M.Alexandre, M.Clerc (Dept. de Phys.-Chimie, CENS, Gif-sur-Yvette, France).
J. Opt. (France), vol.14, no.1, p.43-8 (Jan.-Feb. 1983).
Describes a tunable coherent source near 16 μm for selective photochemistry studies on UF_6. The device uses a YAG:Nd^{3+} pumped lithium niobate optical parametric oscillator coupled with a cadmium selenide frequency down converter. The components and physical parameters have been optimized leading to an overall optical conversion efficiency of about 6.10^{-3}, i.e. a quantum yield of 0.1. The main characteristics such as beam quality and spectral width have been measured, the last one being 60 mK at 16 μm, for 1.5 mJ pulses. (5 refs.)

Magnetic field effect measurements by time-selective absorption sampling ..... See Entry 64921

The influence of film, paper, and printer spectral characteristics on photofinishing performance ..... See Entry 64975

A colorimetric determination of residual thiosulfate (hypo) in processed paper ..... See Entry 64976

Anisotropy induced in a silver chloride emulsion by two successive beams of white light perpendicularly polarized ..... See Entry 64981

The behaviour of gaseous and organic impurities in the coolant of a nuclear power station with channel type uranium-graphite boiling reactors ..... See Entry 65344

FTIR spectroscopic studies of the matrix photoionization and photolysis products of methylene halides ..... See Entry 65980

Structure and photodecomposition reactions of cations of cyclopentane, cyclohexane, cyclic olefines and dienes in γ-irradiated frozen solutions of CF_3CCl_3. An ESR study ..... See Entry 66031

ESR of cation radicals of methyl-substituted benzenes in a CF_3CCl_3 matrix ..... See Entry 66038

Photochemistry of benzophenone in micelles. Phosphorescence emission from aromatic ketones in micellar solution ..... See Entry 66043

Photophysical properties of benzimidazole and thiabendazole and their homologues. Effect of substituents and solvent on the nature of the transition ..... See Entry 66048

Effects of molecular rotation on electronic relaxation processes in pyrazine and pyrimidine with particular regard to pressure dependence ..... See Entry 66053

Application of the energy gap law to nonradiative, excited-state decay ..... See Entry 66054

Statistical limit of S_1 pyrimidine quenching ..... See Entry 66055

Correspondence between rotational relaxation and collision-induced intersystem crossing in S_1 pyrimidine ..... See Entry 66056

Spectral-kinetic properties of the delayed fluorescence of complex molecules with inhomogeneously broadened energy levels ..... See Entry 66063

Linear dichroism studies of flavins in stretched poly(vinyl alcohol) films. Molecular orientation and electronic transition moment directions .. See Entry 66069

Fe emission yield and photoionization of $Fe(CO)_5$ by vacuum-ultraviolet radiation ..... See Entry 66079

Dynamics of photodissociation of HONO at 369 nm: motional anisotropy and internal state distribution of the OH fragment ..... See Entry 66080

Direct measurement of CF_3I multiphoton dissociation yield by iodine-laser detection of iodine atoms ..... See Entry 66081

Theoretical and experimental investigation of electronically excited states, luminescence properties, and lasing capability of pyrene and its phenylethynyl derivatives ..... See Entry 66266

Gamma irradiation induced photochemical reactions in V-doped borate glasses ..... See Entry 67047

Photoelectrochemical study of TiNi alloy oxide layer ..... See Entry 67776

Solvation effects in the phototautomerization of 7-quinolinol .. See Entry 68761

Polymerization of 16-heptadecenoic acid monolayers ..... See Entry 68777

82.50E Photodissociation, photoionization as studied by luminescence and radiationless transitions

Fe emission yield and photoionization of $Fe(CO)_5$ by vacuum-ultraviolet radiation ..... See Entry 66079

82.60 CHEMICAL THERMODYNAMICS

(see also 05.70 Thermodynamics)

68788 Estimation of free energy of formation of $Mg_3V_2O_8$ between 298 and 1200K. S.K.Lau (Westinghouse Res. & Dev. Center, Pittsburgh, PA, USA).
J. Mater. Sci. Lett. (GB), vol.2, no.4, p.137-8 (April 1983).
The free energy of formation (ΔG_f^0) of $Mg_3V_2O_8$ between 298 and 1200K is estimated from that of $Mg_2V_2O_7$, by the application of thermodynamic principles. (8 refs.)

68789 Results of investigations of the enthalpies of melting of salt eutectics. E.K.Rodionova, N.M.Martynova, L.I.Cherneeva (G.M. Krzhizhanovskii Energy Inst., USSR).
High Temp. (USA), vol.20, no.4, p.556-61 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.671-6 (July-Aug. 1982). [received: April 1983]
Results are discussed of the measurements carried out to date of the enthalpies of melting of salt eutectics. A method is proposed for calculating ΔH_m for a series of eutectics by estimating the enthalpies of mixing from the phase diagrams. Results are presented for the calculation of ΔH_m of salt eutectics based on the additivity of the entropy. (23 refs.)

68790 Heat capacities of solution for alcohols in polar solvents and the new view of hydrophobic effects. D.Mirejovsky, E.M.Arnett (Dept. of Chem., Duke Univ., Durham, NC, USA).
J. Am. Chem. Soc. (USA), vol.105, no.5, p.1112-17 (9 March 1983).
Heat capacities of solution ($\Delta C_{p2}°$) are presented for methanol, 1-butanol, and 1-pentanol in dimethyl sulfoxide, *N,N*-dimethylformamide, *N*-methylformamide, ethylene glycol, and ethylammonium nitrate, a low-melting fused salt. In all cases, $\Delta C_{p2}°$ values are negligible compared to those in water. The unique heat capacity behavior of aqueous solutions persists even in concentrated solutions of urea. Water-like behavior was suggested by the heats, entropies, and free energies of solution for nonpolar gases in ethylammonium nitrate, by a nearly ideal heat of mixing with water, and by the ability of this solvent to produce micelles from surfactants. The failure of ethylammonium nitrate to exhibit water-like heat capacity behavior differentiates those properties of water which are due to fluctuations between forms of different geometry and density from those which are caused by its high cohesive energy. (69 refs.)

68791 The hydrogen chloride dimer energy from the second virial coefficient. J.G.Powles, M.Wojcik (School of Chem. Engng., Cornell Univ., Ithaca, NY, USA).
J. Chem. Phys. (USA), vol.78, no.8, p.5277-8 (15 April 1983).
There is currently considerable interest in the interaction potential between simple polar molecules and in particular for hydrogen choride. The authors consider one important aspect of the intermolecular potential, the dimer-interaction energy. The authors use recent accurate data for the pressure second virial coefficient B(T) for HCl over a wide range of temperatures and the method of Lambert to evaluate the enthalpy of dimer formation. (14 refs.)

68792 Calorimetrical investigation of the interaction between stannic tetrachloride and diethyl ether in nitrobenzol and 1,2-dichloroethane solutions. N.A.Morozova, Yu.V.Kondratiev, A.V.Suvorov, V.N.Osokin.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.108-10 (Feb. 1983). In Russian.
The method of calorimetrical titration with continuous addition of titrant is used for investigating the interaction between $SnCl_4$ and Et_2O in solutions of $C_2H_4Cl_2$ and $C_6H_5NO_2$. It is found that the enthalpies of addition of the second donor molecule to $SnCl_4$ in somewhat less than enthalpies of addition of the first molecule. (3 refs.)

68793 A shifted equilibrium equation for reactions with variable composition phases. A.N.Marinichev.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.118-20 (Feb. 1983). In Russian.
Equations describing the phase process for variable composition phases are derived from generalized differential van der Waals equations and mass balance conditions. The proposed equations are used for estimating entropy variation during the condensation of ternary heterozeotrope in the system nitromethane-water-*n*-hexane. (8 refs.)

XIII Congress of Theoretical Chemists of Latin Expression ...See Entry 64573

Solvent effect on the correlation between dipole increment and complexation enthalpy in charge transfer complexes ......See Entry 65907

Magic numbers for argon and nitrogen cluster ions ......See Entry 66170

Colling rate dependence of the icer I nucleation temperature in aqueous LiCl solutions ......See Entry 67171

Sublimation behavior of molybdenum oxides ......See Entry 67181

Demixing of micelles of fluorocarbon and hydrocarbon surfactants. Effects of hydrophobic and hydrophilic groups of hydrocarbon surfactants ......See Entry 67221

Investigation of the Hall effect in liquid gallium antimonide near the melting point ......See Entry 67660

Thermodynamic treatment of chemiluminescence efficiency .....See Entry 68337

The active role of the solvent in chemical reactivity ......See Entry 68757

A theoretical study of the solvent effect on dissociation reactions. The role of the first solvation shell ......See Entry 68760

82.65 SURFACE PROCESSES

68794 The finite and infinite cubes as models for understanding heterogeneous catalysis. L.Salem, R.Elliott (Lab. de Chimie Theorique, Univ. de Paris-Sud, Orsay, France).
THEOCHEM (Netherlands), vol.10, p.75-84 (May 1983). (XIII Congress of Theoretical Chemists of Latin Expression, Alghero, Sardinia, 5-8 Oct. 1982).
The finite cube, introduced by Messmer (1977) and by Salem and Leforestier (1977) leads to the same energy bands as one would obtain by the Slater-Koster method for an infinite metallic cubic crystal. Realistic calculations may thus be performed on a cube with N atoms along each dimension, with N allowed to become infinite whenever necessary. In this manner the authors study the interaction at the (xy) surface of the cube between a diatomic (H_2) molecule and the d_{xz} and s molecular orbitals of the metal. The interaction between the σ_x* orbital of H_2 and the d (or s) band, for instance, is proportional to $\cos 1/2.l\pi/N+1$(or $\sin 1/2.l\pi/N+1$) where l is the quantum number which labels the metal orbitals along the x direction (top of band: l+1 for d band; l=N for s band). As an illustration, results are given for the perturbative interaction between H_2 and metal bands filled up to the Fermi level. (8 refs.)

68795 Magnetocatalytic effect on rare earth oxides. J.Jugel, G.-M.Schwab, J.Voitländer (Inst. fur Phys. Chem., Univ. Munchen, Munchen, Germany).
J. Chem. Phys. (USA), vol.78, no.7, p.4755-62 (1 April 1983).
The rates of ortho-para hydrogen conversion on some self-supported rare earth oxides have been measured at room temperature. The change of the rates by application of a weak external magnetic field has been determined. Only on Pr_2O_3 and Yb_2O_3 a small decrease of the rates could be observed. On the basis of two coupled proton spins under the influence of a magnetic field—composed of an extrinsic and an intrinsic part—a simple theory is given which explains the occurrence, the sign and also the field dependence of the magnetocatalytic effect. It is found that the sign depends upon the mutual orientation of the H_2 molecules and the magnetic moments of the active sites. Finally, the theory allows one to deduce the well-known formula for the ortho-para hydrogen conversion rate given by Wigner (1933). (11 refs.)

68796 Field induced and surface catalyzed formation of novel ions: a pulsed-laser time-of-flight atom-probe study. T.T.Tsong, T.J.Kinkus, C.F.Ai (Phys. Dept., Pennsylvania State Univ., University Park, PA, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4763-75 (1 April 1983).
High electric field induced formation of novel ions such as H_3^+, AuH_2^+, $RhHe^{2+}$, and $PtHe_2^{2+}$ on metal surfaces has been studied in the pulsed-laser time-of-flight atom-probe field ion microscope. From the fractional abundances, and the high resolution mass spectra and energy distributions measured for these ions, several conclusions can be drawn. Field desorption of hydrogen below the evaporation field of the substrate often results in formation of H_3^+ ions. This formation depends not only on the applied field strength, but surprisingly also on the material and the atomic structure of the substrate. Plenty of H_3^+ ions can be found from the high index planes and the lattice steps of Mo, W, and Au surfaces in the field range of 2 to 3 V/Å. Few are found from Ir and Ni surfaces, and none are found from the densely packed W(110) plane. Formation of H_3^+ can therefore be considered a surface catalyzed and field induced chemical reaction. Using H_2-D_2 mixed gases, the authors find little correlation between the ionic species observed in field desorption and the chemisorption states of the gases estimated to be on the order of 5×10^{-13} s. (25 refs.)

68797 A static SIMS rate measurement of the reaction $2H(a)+O(a)\rightarrow H_2O(a)$ on Pt(111). K.M.Ogle, J.R.Creighton, H.S.Luftman, J.M.White (Dept. of Chem., Univ. of Texas, Austin, TX, USA).
J. Chem. Phys. (USA), vol.78, no.9, p.5839-40 (1 May 1983).
The authors report a study of the rate of reaction between two chemisorbed reactants H(*a*) and O(*a*) to form a chemisorbed product $H_2O(a)$ on a single crystal transition metal surface Pt(111). This kind of information is important for the detailed molecular level description of the reaction $H_2(g)+1/20_2(g)\rightarrow H_2O(g)$ catalyzed by platinum. The catalyzed reaction involves nonactivated dissociative chemisorption of H_2. The activation energy for the formation of chemisorbed H_2O can thus be calculated by measuring its rate of formation when O(*a*) is exposed to $H_2(g)$. (9 refs.)

68798 Quantitative treatment of micellar effects upon the nucleophilicity of halide ions. H.Al-Lohedan, C.A.Bunton, J.R.Moffatt (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.332-5 (20 Jan. 1983).
Nucleophilic attack upon methyl benzenesulfonate (1) by Cl^- or Br^- occurs readily in aqueous cetyltrimethylammonium chloride or bromide (CTACl or CTABr, respectively). The increase of rate constant with [surfactant] can be analyzed in terms of the concentration of 1 and halide ion in the micellar pseudophase, and the second-order rate constants in micellar and aqueous pseudophases are similar. (35 refs.)

68799 Micellar effects upon dephosphorylation in water and aqueous 1,2-diols. C.A.Bunton, L.-H.Gan, F.H.Hamed, J.R.Moffatt (Dept. of Chem., Univ. of California, Santa Barbara, CA, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.336-41 (20 Jan. 1983).
Cationic micelles of cetyltrimethylammonium bromide and chloride (CTABr and CTACl) in aqueous ethane- and propane-1,2-diol speed the reaction of OH^- with *p*-nitrophenyl diphenyl phosphate (pNPDPP). The reaction with F^- was examined in aqueous ethane-1,2-diol. The rate-surfactant profiles have been treated quantitatively by use of the ion-exchange pseudophase model and, for the reaction with OH^-, direct comparison has been made with the profile for reaction in aqueous CTABr. (40 refs.)

68800 Effect of the diffusion boundary layers on the surface charge density in passive membranes. J.A.Ibanez (Dept. of Thermal Sci., Autonomous Univ. of Barcelona, Barcelona, Spain), A.Hernandez, A.F.Tejerina.
J. Non-Equilibrium Thermodyn. (Germany), vol.7, no.6, p.363-70 (1982).
The superficial charge density of a passive membrane may be determined from the Gouy-Chapman double layer potentials on the membrane surfaces. A method to obtain the Gouy-Chapman potentials, which was explained by the authors (1982) in a previous paper, is modified considering the influence of the diffusion layers adhered to the membrane. The modified method is applied to several Nuclepore membranes bathed by two solutions of NaCl at different concentrations, getting then their surface charge densities. The dependence of these charge densities as related to the most concentrated solution is studied here. (8 refs.)

68801 Properties of small metal particles. R.C.Baetzold, J.F.Hamilton (Res. Labs., Eastman Kodak Co., Rochester, NY, USA).
Prog. Solid State Chem. (GB), vol.15, no.1, p.1-53 (1983).
The intense interest among both academic and industrial scientists in heterogeneous catalysis over the past few years is certainly apparent from even a cursory review of the scientific literature. It is hardly necessary to point out, therefore, that this practical application has provided a strong incentive for the study of small metal clusters, with the aim of gaining working control of their catalytic activity. Small metal particles arouse curiosity also for more fundamental reasons. It seems basic to an understanding of the condensed state to know how electronic and other properties change as metal atoms come together to form dimers and trimers and so on, until finally a unit develops that has the full characteristics of the bulk solid. Indications of unique behavior of small clusters, together with the development of many new experimental and theoretical techniques, have resulted in a focusing of much effort on this area of research and the generation of many new data. As a result the level of understanding in this field has advanced significantly over the past few years. The authors review some of the major developments in the science of very small metal clusters. (217 refs.)

68802 Esters dissociatively adsorb on alumina. A.Bayman, P.K.Hansma (Dept. of Phys., Univ. of California, Santa Barbara, CA, USA), L.H.Gale.
Surf. Sci. (Netherlands), vol.125, no.3, p.613-23 (March 1983).
Inelastic electron tunneling spectra for esters of the form RCOOR′ show that these compounds dissociate on alumina and only the $RCOO^-$ ion bonds to the surface. For phenethyl benzoate, ethyl-d_5 benzoate, benzyl-d_7 benzoate, the benzoate ion is symmetrically adsorbed. For ethyl-d_5 acetate, the spectrum is distinguishable from the spectrum of a symmetrically bonded acetate ion. (34 refs.)

68803 On the influence of the electrode nature on electroosmotic fluid velocity in quartz powder diaphragms. N.G.Sharova, N.Yu.Tumakova, A.F.Rabinovich.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.121-3 (Feb. 1983). In Russian.
Changes in electroosmotic velocity in active diaphragms are investigated using different electrodes. Different changes in electroosmotic velocity can be explained by physico-chemical reactions on the surface. (6 refs.)

Formation and properties of americium colloids in aqueous systems .... See Entry 65375

Atomic physics of negative ions: a report on the US-Mexico joint workshop .... See Entry 65848

Computer simulation of laminar dilute suspension flows in asymmetric pressure-driven membrane units .... See Entry 66624

Glass surfaces—1982 .... See Entry 67318

Stability and reactivity of (001) and (111) NiO: a RHEED-AES investigation of Si surface segregation and Ni formation by gas reduction .... See Entry 67326

SIMS-AES investigations on water vapour adsorption on nickel (100) at room temperature .... See Entry 67340

Rotational cooling of rigid rotors desorbed from flat surfaces .... See Entry 67341

Cluster studies of CO adsorption. III. CO on small Cu clusters .... See Entry 67344

Chemisorptive properties of Pt-Ni(111) single crystal alloys with high platinum content: C_2H_4 and C_6H_6 adsorption .... See Entry 67366

Vibrational excitations of hydrogen and oxygen on Pd(100) .... See Entry 67367

Infrared-laser-induced desorption by resonant multiphoton excitation of adsorbate vibration in CH_3F-NaCl at different coverages .... See Entry 67368

SO_2 adsorption and desorption kinetics on Pt(111) .... See Entry 67371

Competition among adsorbed species for surface sites on Ag electrodes as determined by SERS .... See Entry 68236

Ethylene on silver: development of surface enhanced Raman lines with exposure .... See Entry 68238

EELS identification of the adsorbed species from acetone adsorption on Pt(111) .... See Entry 68376

Comment on 'Molecule formation during sputtering by two-body associative ionization with diabatic curve crossing .... See Entry 68390

Two valence states in oxidized europium metal .... See Entry 68397

AES study of the low-pressure oxidation of Si(100): electron beam effects .... See Entry 68678

Changes of certain properties of applied and nonapplied matrices of zirconium hydroxide in the course of ageing .... See Entry 68805

Quantitative determination of catalytic surface adsorption sites by Fourier transform infrared photoacoustic spectroscopy .... See Entry 68815

82.70 DISPERSE SYSTEMS

(for flow behaviour, see 47.55K)

68804 The measurement of emulsion phase voidage in gas fluidized beds of fine powders. G.F.Barreto, J.G.Yates, P.N.Rowe (Dept. of Chem. & Biochem. Engng., Univ. Coll. London, London, England).
Chem. Eng. Sci. (GB), vol.38, no.3, p.345-50 (1983).
The results of two different experimental methods, X-ray absorption and bed collapse, for the determination of the emulsion-phase voidage of gas fluidized beds are compared. It is shown that good agreement exists between them over the range of gas velocities studied, but that possible differences in voidage in an axial direction are only revealed by the X-ray technique. The bed collapse method applied to a Geldart Group A powder confirms that there is little difference between the surface settling rates of a bubbling bed and of a uniformly expanded bed of the same voidage. (9 refs.)

68805 Changes of certain properties of applied and nonapplied matrices of zirconium hydroxide in the course of ageing. Yu.I.Sukharev, V.V.Rudneva, Yu.V.Egorov (Sergo Ordzhonikidze Siberian Metall. Inst., USSR).
Inorg. Mater. (USA), vol.18, no.6, p.826-30 (June 1982). Translation of: *Izv. Akad. Nauk SSSR Neorg. Mater.*, vol.18, no.6, p.983-7 (June 1982). [received: Feb. 1983]
The introduction of selenite ions as applicant materials into the matrix of zirconium hydroxide during the synthesis leads to a narrow molecular weight distribution for the gels; this implies good reproducibility and control of the synthesis. An increase in the concentration of the applicant material shifts the maxima toward lower molecular weights. The conformational features of the polymeric species formed in the process of removing the applicant material by caustic tend to favour olation cross-linking of the matrix (holding for 30-60 days) on the background of its hydration. The well-developed network of strong hydrogen bonds that is formed in this case has the end result of breaking up these formations, with a narrowing of the molecular weight distribution and the formation of a 'second hydrate shell'. A similar breakdown has been noted for the nonapplied samples. In these cases, the hydrogen bond is the main factor in structural self-organisation of the gel system when it is far from equilibrium conditions. The sorption and other properties of hydroxide gels must be related not only to the features of the synthesis and the conditions under which the material is to operate, but also to the time parameter, i.e. the age of the particular sorbent under investigation must be indicated. The ion application method can provide a means for a considerable stabilisation of HZD gel properties with respect to time. (8 refs.)

68806 Variational model for micelle structure. F.H.Stillinger (Bell Labs., Murray Hill, NJ, USA).
J. Chem. Phys. (USA), vol.78, no.7, p.4654-61 (1 April 1983).
A free energy variational principle is proposed for the study of aggregation structures in amphiphile solutions. For nonionic amphiphiles the postulated free energy functional depends on the scalar concentration fields for solvophilic head groups (H) and solvophobic tail groups (T); it has a form appropriate for a binary mixture of head-group chains and tail-group chains supplemented by a term that enforces chemical bond connection between pairs of those chains. Numerical solutions to the Euler equations for the variational principle are presented for molecules with formal constitution $(H)_{10}$ $(T)_{10}$, under conditions of spherical aggregate symmetry. These solutions include globular micelles, hollow vesicles, and a type of point defect in a smectic A lamellar system. (19 refs.)

68807 Comparative studies between monomeric and polymeric sodium 10-undecenoate micelles. C.M.Paleos, C.I.Stassinopoulou, A.Malliaris (Nuclear Res. Center 'Demokritos', Athens, Greece).
J. Phys. Chem. (USA), vol.87, no.2, p.251-4 (20 Jan. 1983).
When aqueous solutions of sodium 10-undecenoate at concentrations above the CMC of the surfactant (8.24 g/dm^3; 0.04 M) are irradiated by γ rays the low molecular weight polysoap poly(sodium 10-undecenoate) is formed which has a degree of polymerization equal to ten and exhibits micellar behavior by solubilizing hydrophobic molecules. Fluorescence studies with the micropolarity probe pyrene show that the fluorophore penetrates the intramolecular polymeric micelle less than the monomeric one. When the concentration of poly(sodium 10-undecenoate) in water exceeds 2.06 g/dm^3 hydrophobic aggregation of intramolecular micelles occurs which leads to the formation of large 'intermolecular' micelles having an intrinsic viscosity of 0.079100 mL/g compared to 0.048100 mL/g for the intramolecular and monomeric micelles. (14 refs.)

68808 Static and dynamic light scattering studies of micellar growth and interactions in bile salt solutions. P.Schurtenberger, N.Mazer, W.Kanzig (Lab. fur Festkorperphys., ETH, Zurich, Switzerland).
J. Phys. Chem. (USA), vol.87, no.2, p.308-15 (20 Jan. 1983).
From static and dynamic light scattering measurements the authors have deduced the apparent mean aggregation number ($\bar{n}_{app}$) and mean hydrodynamic radius $(R_H)_{app}$ for sodium taurodeoxycholate (TDC) micelles as a function of TDC concentration (0.25-10 g/dL) in 0.8 M NaCl at 20°C. The data are analyzed in terms of a general theoretical framework incorporating the possible influences of micellar growth and micellar interactions. The studies provide strong support for the view that TDC micelles grow into elongated structures above the CMC in the presence of high NaCl concentration. (46 refs.)

68809 Computer simulation of a model for irreversible gelation. H.J.Herrmann (Dept. of Phys. & Astron., Univ. of Georgia, Athens, GA, USA), D.Stauffer, D.P.Landau.
J. Phys. A (GB), vol.16, no.6, p.1221-39 (21 April 1983).
A random mixture of bifunctional and tetrafunctional units is placed on a simple cubic lattice. Permanent bonds between these units are then formed by the random motion of active centres (radicals) resulting in a model for the gelation of polyacrylamide and similar processes. The largest of the clusters formed by this kinetic percolation process is identified with the gel fraction, the 'mean cluster size' with the weight-average degree of polymerisation. The critical exponent γ of the mean cluster size is roughly the same as for random percolation, that is, different from that of the 'classical' theory of Flory (1941) and Stockmayer (1943), but the corresponding amplitude ratio, that is, the ratio of average molecular weight on both sides of the gel point, differs strongly from its value in random percolation. Thus, this kinetic gelation model seems to belong to a universality class of its own, different from both that of random percolation and that of classical gelation theories. (45 refs.)

68810 Flows of magnetizable fluid with a bounded free surface. V.G.Bashtovoi, R.A.Foigel'.
Magnetohydrodynamics (USA), vol.18, no.3, p.231-6 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.27-32 (July-Sept. 1982). [received: April 1983]
The perspectives of the practical application of the flow of a magnetizable fluid with a free surface in a number of het and mass transfer processes have been repeatedly noted in the literature. Film flow of magnetizable fluids have been discussed in a number of works which considered the hydrodynamics and stability of the laminar flow of the film, the stability of tangential break in jet flows, the convective and surface instability of nonisothermal layers of a magnetizable fluid, and other problems. These works studied either planar infinite, or circular cylindrical, layers with axial symmetry. In real instruments which use magnetizable fluids, however, other geometrical forms of the layers are realized whose characteristic feature is the boundedness of the free surface. In this case, the earlier results are either inaccurate, or cannot be used at all. Therefore, the work is devoted to the study of the hydrodynamics of similar flows, and the effect on these flows of the geometrical form of the layer. (6 refs.)

68811 Experimental investigation of effective magnetic fields in a magnetic fluid. Yu.I.Dikanskii.
Magnetohydrodynamics (USA), vol.18, no.3, p.237-40 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.33-6 (July-Sept. 1982). [received: April 1983]
An important part of current research on magnetic fluids (MF) is the investigation of the dipole interaction of particles and the associated structural state of such systems. The author investigates the effective magnetic fields in magnetic fluids due to the orientational effect of the particles on one another. The constants of the effective field are calculated from the temperature and concentration dependences of the differential magnetic susceptibility. (5 refs.)

68812 Magnetic properties of highly conducting magnetic liquids. B.B.Sviklis.
Magnetohydrodynamics (USA), vol.18, no.3, p.241-4 (July-Sept. 1982). Translation of: *Magn. Gidrodin. (USSR)*, vol.18, no.3, p.37-41 (July-Sept. 1982). [received: April 1983]
The author presents the characteristics of the influence of various external effects on the magnetic properties of liquid, highly conducting magnetizable media, especially within the ranges of maximum sensitivity of these systems to the effects of various factors, and also in the regions where their magnetic characteristics vary in a nonmonotonic manner. In the majority of cases considered, controlling roles are played both by the variation of the initial magnetic susceptibility for the liquid $\dot{\chi}$, its magnetization saturation M_n, the magnetic component of the yield stress τ_{MD} and the variation of the magnetic moment m, the energy of magnetic anisotropy W_a, the amplitude of the fluctuation in the field of thermal motion of the magnetic moment A_F and the energy of the dipole-dipole interaction $W_{MT} = W_M/kT$ for the magnetizable particle. (2 refs.)

68813 Theory of thermophoresis of moderately large aerosol particles. A.B.Poddoskin, A.A.Yushkanov, Yu.I.Yalamov (N.K. Krupskaya Regional Pedagogic Inst., Moscow, USSR).
Sov. Phys.-Tech. Phys. (USA), vol.27, no.11, p.1383-8 (Nov. 1982). Translation of: *Zh. Tekh. Fiz. (USSR)*, vol.52, no.11, p.2253-61 (Nov. 1982). [received: May 1983]
A systematic theory is developed for thermophoresis of moderately large spherical aerosol particles in the context of gas dynamic theory. Nonuniform gas kinetic theory is used to derive the boundary conditions for the temperature and velocity components. An ellipsoidal model is used to handle the collision integrals in the Boltzmann equation. The boundary conditions are then used to calculate the thermophoresis rate of moderately large aerosol particles. (19 refs.)

Model experiment illustrating sedimentation by microcomputer .... See Entry 64628

Remarks about calibration of automatic analyser of aerosols . See Entry 64883

Anisotropy induced in a silver chloride emulsion by two successive beams of white light perpendicularly polarized .... See Entry 64981

Formation and properties of americium colloids in aqueous systems .... See Entry 65375

Radiation induced sodium metal colloid formation in natural rock salt from different geological localities .... See Entry 65403

Hydrogen combustion in aqueous foams .... See Entry 65641

Quality of image transmission by light-scattering layers with different particle packing .... See Entry 66226

Regularizing the solution of the laser sounding equation of atmospheric aerosols by means of a stabilizing functional .... See Entry 66316

Computer simulation of laminar dilute suspension flows in asymmetric pressure-driven membrane units .... See Entry 66624

Viscometry of a magnetic fluid in weak fields .... See Entry 66655

Demixing of micelles of fluorocarbon and hydrocarbon surfactants. Effects of hydrophobic and hydrophilic groups of hydrocarbon surfactants .... See Entry 67221

Theory of the effective viscosity of magnetofluids. II. Contribution of anisotropy to the effective viscosity .... See Entry 67261

Light polarization by chains of highly dispersed Fe, Co, and Ni particles .... See Entry 68255

A simple model of the polymerisation process .... See Entry 68776

Heat capacities of solution for alcohols in polar solvents and the new view of hydrophobic effects .... See Entry 68790

Quantitative treatment of micellar effects upon the nucleophilicity of halide ions .... See Entry 68798

Micellar effects upon dephosphorylation in water and aqueous 1,2-diols .... See Entry 68799

82.80 CHEMICAL ANALYSIS AND RELATED PHYSICAL METHODS OF ANALYSIS

68814 Multiplex methods in atomic spectroscopy. K.W.Busch, L.D.Benton (Dept. of Chem., Baylor Univ., Waco, TX, USA).
Anal. Chem. (USA), vol.55, no.3, p.445A-60 (March 1983).
Multielement analysis is an area of research aimed at increasing the efficiency of analytical atomic spectroscopy. Ever since the development of spectrography, workers have consistently sought electronic alternatives to photographic detection. The article is concerned with electronic multiwave-length detection methods, collectively referred to as multiplex methods. (62 refs.)

68815 Quantitative determination of catalytic surface adsorption sites by Fourier transform infrared photoacoustic spectroscopy. J.A.Gardella,Jr., Da-Zhen Jiang, E.M.Eyring (Dept. of Chem., Univ. of Utah, Salt Lake City, UT, USA).
Appl. Spectrosc. (USA), vol.37, no.2, p.131-3 (March-April 1983).
The use of Fourier transform infrared photoacoustic spectroscopy (FT-IR/PAS) as a method for quantitative analysis of surface adsorption sites is demonstrated. A calibration curve is constructed for the amount of CO(g) in the sample cell with a silica internal reference. This calibration curve is utilized to calculate the amount of CO(ads) by subtraction on a catalytic surface where both CO(g) and CO(ads) exist at equilibrium. This analysis combines the qualitative analytical capabilities of PAS with quantitative analysis. (22 refs.)

68816 Fourier transform infrared evolved gas analysis (FT-IR-EGA). J.O.Lephardt (Philip Morris Res. Center, Richmond, VA, USA).
Appl. Spectrosc. Rev. (USA), vol.18, no.2, p.265-303 (1982-1983).
Since their commercial introduction, Fourier transform infrared spectrophotometers have enabled a variety of new infrared applications not possible or practical with other spectrophotometers. One such application—evolved gas analysis (EGA)—has received relatively little attention although its potential is quite significant. A discussion of the background of Fourier transform infrared evolved gas analysis (FT-IR-EGA), the experimental considerations of this technique, and some application areas for this technique are presented. (13 refs.)

68817 Compositional characterization of microwave plasma a-Si:H films. J.F.Currie, P.Depelsenaire, J.P.Huot, L.Paquin, M.R.Wertheimer, A.Yelon (Dept. de Genie Phys., Ecole Polytech. de Montreal, Montreal, Quebec, Canada), C.Brassard, J.L'Ecuyer, R.Groleau, J.P.Martin.
Can. J. Phys. (Canada), vol.61, no.4, p.582-90 (April 1983).
The concentration of hydrogen in amorphous hydrogenated silicon films prepared by microwave glow discharge decomposition of silane has been measured as a function of several fabrication parameters: substrate temperature, deposition rate, and partial pressures of silane and of argon. Hydrogen concentration profiles have been obtained by two techniques: elastic recoil detection (ERD) with a 30 MeV ^{35}Cl beam, and by the resonant nuclear reaction $^{15}N+{}^{1}H\rightarrow{}^{12}C+{}^{4}He+\gamma$. Both offer very high depth resolution (in the order of 100 Å) and have revealed important inhomogeneities in chemical composition, both at the free surface and the substrate-film interface. Using standard infrared absorption measurements between 1950 and 2150 cm^{-1}, the intensities of the lines normally associated with SiH, SiH_2, and SiH_3 bonds were measured. As has been previously reported for reactively sputtered films for some fabrication conditions, the sum of the three intensities is not consistent with the total hydrogen concentration obtained from the nuclear measurements. The average hydrogen concentration decreases with increasing substrate temperature, changes little with deposition rate, and increases as the silane to argon ratio is increased. These observations are related to the chemical reactions which take place in the plasma, and at the plasma-film interface during film growth. (24 refs.)

68818 Ion induced X-rays for X-ray fluorescence analysis. L.Grodzins, P.Boisseau (Lab. for Nuclear Sci., MIT, Cambridge, MA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1271-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Energetic ions bombarding pure element targets induce the characteristic X-rays with high probability and with negligible bremsstrahlung background. The cross sections for X-ray production by protons reach 10^3 b and heavy ions attain cross sections Z^2 times higher. Small accelerators can produce monoenergetic X-rays from 1 to 20 keV with fluxes in excess of 10^{10}/sr/μA of protons; heavy ion accelerators can achieve one to two orders of magnitude more. These ion induced X-rays can be quite effective for X-ray induced X-ray fluorescence. For bulk samples, the method of IXX is as sensitive as PIXE itself; for many elemental analysis problems IXX may be the preferred technique. (16 refs.)

68819 External beam PIXE programs at the University of California, Davis. R.A.Eldred (Crocker Nuclear Lab., Univ. of California, Davis, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1276-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A PIXE system in which large or delicate samples are excited by a low-current external proton beam is described. This system has been used to analyze historical printed books and manuscripts, as well as a large variety of archeological artifacts. The steps used to protect the sample from unnecessary beam current are examined. A recent thorough study of the first volume of the Gutenberg 42-line Bible is described in some detail. (6 refs.)

68820 Depth profiling using proton induced X-rays: the influence of experimental and theoretical uncertainties. M.Geretschlager, H.Paul (Inst. fur Experimentalphys., Johannes-Kepler-Univ. Linz, Linz, Austria).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1280-1 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The mean depth (a), the mean width (b) and the relative concentration (c) of an unknown distribution of foreign atoms in bulk material can be determined by relative X-ray yield measurements. It is shown by means of a set of case studies for rectangular distributions of foreign Cu-atoms in Ag-bulk to which extent experimental X-ray yield errors, and errors in the theoretical description of the X-ray production process and the stopping of projectiles contribute to errors in the result. The theoretical description uses the ECPSSR theory and takes experimental deviation from this theory, energy loss straggling and multiple scattering into account. (19 refs.)

68821 Sputtering analysis with PIXE. J.M.Lambert, P.A.Treado (Georgetown Univ., Washington, DC, USA), D.Trbojevic, R.G.Allas, A.R.Knudson, G.W.Reynolds, F.R.Vozzo.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1285-90 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The applicability of the particle induced X-ray emission (PIXE) in the determination of sputtering distributions and yields was studied. Sputtered particles were caught on foils for the 45 keV to 125 keV selfsputtering of Fe, Ni, Cu, Ti, Mo and Au and for the 90 keV sputtering of both target and implanted particles of $Ni^{+}+Cu$, $Cu^{+}+Ni$, $Ni^{+}+Fe$, and $As^{+}+Ag$, and for the target particles of $Ar^{+}+Au$. (9 refs.)

68822 Application of in-air PIXE for corrosion-erosion studies of metal surfaces. Cheng-Ming Fou (Dept. of Phys., Univ. of Delaware, Newark, DE, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1291-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Two methods are presented to demonstrate the usefulness of in-air PIXE for studying environmental corrosion and erosion of metal surfaces. (1) Surface adsorption of corrosive vapors on gases in the ppm range is detected with the in-air PIXE technique. The adsorbed chlorine and argon can be pumped away with moderate (200°C) heating of the metal surface. Therefore such investigation can only be done with the in-air PIXE. (2) Airborne particulates with high velocity, such as sands in the desert wind, can erode metal surface. They can also imbed foreign materials into the metal surface. Those foreign materials may lead to surface corrosion. Metal surface and the glass beads of a sand-blaster, before and after sand-blasting, were examined with in-air PIXE to show its sensitivity and the ease with which it can detect minute quantities taken off or imbedded into the metal surface after just a short blasting time. (3 refs.)

68823 PIXE analysis of aerosol in the workplace. E.T.Williams, L.W.Punyasena (Dept. of Chem., City Univ. of New York, New York, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1294-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Sampling programs of relatively limited extent can be useful for monitoring suspended particulate matter in specific locations; for example certain occupational situations. Aerosol samples were collected by cascade impactors and analyzed by PIXE at the Brooklyn College Dynamitron Laboratory. The authors describe the results of experiments in a metal-sculpture studio involving silver soldering, an industrial plastics-milling shop and a municipal incinerator. (8 refs.)

68824 Proton induced X-ray studies of the shell of living oysters and of archaeological artifacts. C.P.Swann (Franklin Inst., Univ. of Delaware, Newark, DE, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1298-301 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
For a number of years the principal efforts of the author have been in collaboration with investigators in the fields of marine biology and archaeology. This report is specific to the study of the elemental composition of the shell of living oysters and to archaeological glass and faience beads and pendants and Cu-based alloy artifacts from the Middle East. It is obvious that living oysters cannot be subjected to vacuum and must not be damaged; practical aspects limit the use of vacuum for the archaeological artifacts. It is also important that the technique be multielemental in order to minimize the time required to obtain the data. All of these studies were, therefore, peformed with in-air (or helium) PIXE with a beam diameter of 0.45 mm. The results given are not final in that all of the researches are on-going and will not be completed for some months. However, the success of the technique is clearly demonstrated and some preliminary conclusions can be drawn. (8 refs.)

68825 Application of proton induced X-ray emission (PIXE) technique to gunshot residue analyses and other crime related problems. P.Sen (Saha Inst. of Nuclear Phys., Calcutta, India), G.K.Mehta.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1302-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The PIXE technique has been successfully applied to gunshot residue analyses and other crime related problems. The experimental arrangements and practical problems involved are discussed. Reproducibility and consistency checks are presented. The results demonstrate the sensitivity of the PIXE technique, its non-destructive nature, its role in determining the distance from the gun to the victim, the identification of the type of bullet used, whether a wound is made by a bullet or not and its usefulness in identification and evaluation of vital parameters related to a crime. (11 refs.)

68826 Deposition characteristics of corrosive salts in electric steam generating systems using ion beam analysis. J.G.Pronko, T.T.Bardin, I.V.Chapman, D.Kohler (Lockheed Palo Alto Res. Lab., Palo Alto, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1305-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A method is described for the in situ detection of trace amounts of the isotopes contained in corrosive salts which have been deposited on the surface of metal alloys from dry steam at temperatures and pressures prevalent in nuclear steam turbine systems. The technique involves the use of ion beam induced resonant nuclear reactions with the trace elements. Detection of the resulting reaction γ-rays serves as a means of identifying and quantifying the trace element abundance deposited under given temperature and pressure conditions. Preliminary results, obtained with this technique for NaCl on metal alloys relevant to the power industry, suggest a monolayer detection sensitivity is possible. (3 refs.)

68827 Proton induced characteristic X-ray radiography. G.M.Thomson (US Army ARRADCOM Ballistic Res. Lab., Aberdeen Proving Ground, MD, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1335-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A new accelerator-based technique for measuring the densities of rapidly changing multiphase media, characteristic X-ray radiography (CXR), has been developed. It has been successfully tested in a particularly violent regime, the interior of a discharging firearm, where it has produced the first quantitative measurements of the propellant's density. The method is based upon a timewise continuous determination of the attenuation that an energetically well-defined flux of X-rays experiences as it traverses the media. (6 refs.)

68828 Trace element measurements with synchrotron radiation. A.L.Hanson, H.W.Kraner, K.W.Jones, B.M.Gordon, R.E.Mills (Brookhaven Nat. Lab., Upton, NY, USA), J.R.Chen.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1339-42 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Aspects of the application of synchrotron radiation to trace element determinations by X-ray fluorescence have been investigated using beams from the Cornell facility, CHESS. Fluoresced X-rays were detected with a Si(Li) detector placed 4 cm from the target at 90° to the beam. Thick samples of NBS Standard Reference Materials were used to calibrate trace element sensitivity and estimate minimum detectable limits for this method. (5 refs.)

68829 Application of nuclear reaction analysis to stress-induced hydrogen migration in titanium. R.L.Schulte, P.N.Adler (Res. & Dev. Center, Grumman Aerospace Corp., Bethpage, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1343-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The role of hydrogen as a cause of embrittlement and crack initiation in titanium alloys has long been recognized. However, direct experimental observation of the transport and accumulation of hydrogen in regions of high stress in titanium alloys has been sparse. The authors have applied the method of nuclear reaction analysis to the investigation of stress-induced hydrogen redistribution in Ti alloys. A 4 MV Van de Graaff accelerator is used to produce a high energy ^{7}Li ion beam to induce the ^{1}H(^{7}Li, γ)^{8}Be reaction. The measured gamma ray emission rate is proportional to the hydrogen concentration in the sample. (11 refs.)

68830 Measurement of depth distribution of phosphorus in films of phosphosilicate glass by means of ^{31}P(p,α)^{28}Si. E.Norbeck, T.Z.Ma (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1347-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Phosphorus concentrations of a few percent are studied as a function of depth in 1 μm thick films of phosphosilicate glass on silicon using the ^{31}P(p,α)^{28}Si reaction. The proton energy is 5.325 MeV. The α particles are detected at 170°. The depth resolution is better than 0.05 μm. (3 refs.)

68831 The determination of silicon, chromium and cobalt in steels by proton-induced prompt photon spectrometry. D.Gihwala, M.Peisach (Southern Univs. Nuclear Inst., Faure, S Africa).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1349-52 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Prompt γ-ray spectra from pure samples of Si, Cr and Co induced by protons between 3.5 and 6.0 MeV were used to evaluate the analytical feasibility of the method and to calculate interference-free sensitivities. The bombarding energy was selected from experimentally determined sensitivity curves and the method was tested on NBS standard steels. (12 refs.)

68832 14-MeV neutron activation analysis of complex materials. G.E.Miller, D.R.Burtner, P.A.Jerabek (Dept. of Chem., Univ. of California, Irvine, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1607-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
In principle, activation analysis of chemical samples of use of 14-MeV neutrons (Fast Neutron Activation Analysis, or FNAA) is a straightforward instrumental technique. As attempts are made to improve the accuracy and precision of the method, and to use the technique for several elements in a wider variety of samples, however, several important effects must be considered. These are categorized as instrumental, chemical, or nuclear and are examined briefly. It may be concluded that most determinations by FNAA are not 'routine' except in the case of determination of a single element in a series of closely related samples in one laboratory. (18 refs.)

68833 Application of on-line laboratory computer analysis to fast neutron activation oxygen determinations. W.D.James, M.S.Akanni (Center for Trace Characterization, Texas A&M Univ., College Station, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1610-13 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The development of an on-line laboratory computer analysis system designed for routine high volume oxygen determinations is discussed. The system is based on the detection of ^{16}N photopeaks from the ^{16}O(n,p)^{16}N reaction occurring during fast neutron irradiation. A system interface has been designed and constructed which is capable of controlling the Kaman 710 neutron generator, the sample transfer system, switching the BF$_3$ beam monitor detector or NaI(Tl) detector outputs as required to a multichannel scaling MCA, and proper sequencing of the procedure. In addition, specific software has been developed for the control of the system during acquisition as well as evaluation of the MCS spectra generated. (6 refs.)

68834 Use of thin layer activation techniques to assess mechanical parts wear. A survey of the industrial experience in France. B.Jeanneau (CEA Isotopes Applications Service, Saclay, France).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1614-18 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Thin layer activation is being used by industry for measurements of wear, erosion and corrosion. Such an activation is produced by bombardment with charged particles. The total activity level can be accurately monitored and if the activity to depth relationship is known, the amount of material worn away can thus be determined. By bombarding a given material with protons, deuterons, ^{3}He, ^{4}He, different radioactive species can be produced. Active layers can be obtained in a variety of materials such as iron, copper, chromium, titanium. The total activity level is weak, from 5 to 100 Ci but it will allow to use this technique in accordance to standard 'Radioactive Substances regulations' for industry. The active layer varies from 10 to 1000 m, the activated area from some square millimeters to 2 squares centimeters and the sample can stand still or be rotated or translated to get a band of activity. Total or worn away activity is measured. The irradiations are made with the Orleans Cyclotron and the development and applications at Saclay Laboratory. (7 refs.)

68835 Studies on polycrystalline silicon for solar applications, including characterization of trace elements B, C and Al by charged particles activation analysis. G.Blondiaux, A.Giovagnoli, M.Valladon, J.L.Debrun (CNRS, Orleans, France), J.Y.Barraud.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1619-22 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Nuclear methods of analysis were used to study the behaviour of trace elements during the metallurgy of polycrystalline silicon for solar applications: these impurities may have an influence on the efficiency of the solar photocells made out of this silicon. (4 refs.)

68836 Quantitative XRF analysis of thick samples of heavy element matrices. R.Govil, S.K.Kataria, H.N.Bajpei (Bhabha Atomic Res. Centre, Bombay, India).
Indian J. Pure & Appl. Phys., vol.20, no.12, p.969-73 (Dec. 1982). [received: April 1983]
A simple semiempirical approach for quantitative elemental analysis of thick planar samples with large absorption and enhancement effects is proposed. In this procedure, the energy-dispersive X-ray fluorescence EDXRF spectrometer and the X-ray tube exciting source are kept in fixed geometry and a number of measurements are carried out with the planar sample, making different angles with the normal to the detector. The relative intensities of the various elements with respect to one of the major constituents are extrapolated to zero effective thickness using regression analysis, and can be converted to the relative elemental concentration by an initial calibration of the system. Based on this technique two standard samples have been analyzed. The accuracy of the analysis by this technique for heavier matrices (7%) is found to be poor as compared to that for lighter matrices (3%). (9 refs.)

68837 Compositional depth profile of a native oxide LPCVD MNOS structure using X-ray photoelectron spectroscopy and chemical etching. J.A.Wurzbach, F.J.Grunthaner (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.691-9 (March 1983).
A compositional profile of a native oxide LPCVD MNOS structure has been obtained by X-ray photoelectron spectroscopy used in conjunction with a stopped-flow chemical etching procedure. A depth resolution of 5-10 Å was achieved. Stoichiometric Si$_3$N$_4$ was found in the bulk with about 0.4 atomic percent oxygen impurity. In contrast to profiles completed by other techniques, SiO$_2$ was found intact at the interface; complete conversion of oxide to oxynitride during LPCVD did not occur. The oxide/nitride interface is best described as sharp; the oxygen concentration drops by 80% in less than 8 Å. There is also a diffuse oxynitride gradient extending into the film, but the oxygen concentration in this region is quite low. Evidence was also found for an 8 Å layer containing excess bonds to silicon between the oxide and nitride layers. Possible charge trap structures that might limit device performance are discussed along with processing suggestions aimed at minimizing the formation of traps. (37 refs.)

68838 The revelation of dynamic contamination ion species and their mass characteristics in ion microprobe mass analysis. Lin Zhuoran (Inst. of Geology, State Seismological Bur., Beijing, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1209-13 (Nov. 1982). [received: April 1983]
One of the fundamental problems in ion microprobe mass analysis is the origin and mass characteristics of the interfacing ion species due to dynamic contamination. In the case of metals and semiconductors, due to insufficient SIMS mass resolution, these interfering contamination ion species always superimpose on compositional ion species and are difficult to identify. Some workers use energy filtering to suppress them to some extent but do not separate them out. In the case of a nonconductor, under positive ion bombardment which caused serious surface charging and suppression of secondary ion emission, a phenomenon completely different from that obtained under negative ion bombardment appears. The author unexpectedly finds that the interfering contamination ions can be isolated from those sputtered compositional ion species by the surface charging effect and their mass spectra can be observed. (8 refs.)

68839 Electrochemical measurement of kinetic analysis—automatic determination of trace iodine in natural waters. Wang Qingzhang, Chen Dechang (Dept. of Marine Chem., Shandong Coll. of Oceanology, Quingdao, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.12, p.1283-8 (Dec. 1982).
A great number of catalytic reactions can be converted into quite simple first-order reactions. Using the ever-expanding electrochemical technique, one can determine the reaction rates of many catalytic systems so conveniently that it will simplify procedures of analysis and computation, increase the number of measured factors, be conducive to auto-analysis, and be suitable to analysis of micro-samples. The authors present an account of the catalytic analysis of total iodine in seawater, interstitial water and artificial rain using a glassy carbon electrode and auto-potentiometer. The results obtained by electrochemical and spectrophotometric techniques are in agreement. (8 refs.)

68840 X-ray fluorescence analysis with a linear polarized beam after Bragg reflection from a flat or a curved single crystal. P.Wobrauschek, H.Aiginger (Atominst., Osterreichischen Univ., Wien, Austria).
X-ray Spectrom. (GB), vol.12, no.2, p.72-8 (April 1983).
Improvements of the detection limits in photon induced X-ray fluorescence analysis are obtained by the reduction of the radiation background using linear polarized X-rays for excitation. A single crystal where Bragg reflection

takes place at an angle $2\theta = 90°$ produces linear polarized and monochromatic X-rays. The use of a single crystal instead of amorphous scattering materials increases the intensity of the polarised beam in some cases up to a factor 10^4. The use of curved crystals instead of standard flat crystal geometries shows a further increase in the intensity of the exciting beam in the focus line. The crystals in use for both geometries are described. Detection limits are given for some elements, absolute amounts of 150 picogram can be detected in some cases. (12 refs.)

68841 Radiochemical neutron activation analysis method for the determination of chromium, cobalt and nickel in tissue samples. A.Reissell, E.-L.Lakomaa.
Report 157, Tech. Res. Centre Finland, Electr. Eng. Lab., Espoo (March 1983), 46 pp. In Finnish.
A radiochemical neutron activation analysis method for the determination of chromium, cobalt and nickel has been developed. The destruction device used consisted of a combined wet-ashing-distillation and ion-exchange system. Six samples could be treated at the same time. The samples were wet-ashed with H_2SO_4-H_2O_2 mixture. Volatile elements were distilled as bromide compounds with HBr^-. The distillation residue in 8M HC1 was passed through hydrated antimony pentoxide (HAP) in order to remove disturbing ^{24}Na-activity and through a Dowex 2×8 column so as to retain ^{60}Co and ^{58}Co (formed from ^{58}Ni). Chromium was elutriated from the column and precipitated as $Cr(OH)_3$ for the removal of disturbing ^{32}P-activity. The standards and samples were treated in a similar manner each so that the yield determination is not necessarily needed. The yields by tracer experiments were (43±5) % for Cr, (93±4) % for Co and (88±14) % for Ni. (19 refs.)

A simple theory to predict small changes in volume and refractivity during mixing of a two-component liquid system .... See Entry 64636

Construction of lines of constant density and constant refractive index for ternary liquid mixtures .... See Entry 64637

Measurement of low oxygen pressures with a solid-state electrolyte miniaturised sensor .... See Entry 64894

Long path length samples in thermal lens calorimetry .... See Entry 64905

Improvement of a pulse generator for the Atom-probe: doubling of pulse-voltage .... See Entry 64992

XPS valence state determination of Np and Pu in multicomponent borosilicate glass and application to leached 76-68 waste glass surfaces .... See Entry 65365

Rutherford backscattering investigation of the corrosion of borosilicate glass .... See Entry 65367

Utilization of charged particle backscattering to study the near surface region of glasses. Application to depth profiling of lanthanium, cerium, thorium and uranium induced by aqueous leaching .... See Entry 65461

Modeling aspects of the PNA technique for flow rate measurements .... See Entry 65564

Preparation of relatively clean carbon backings used in charged particle induced X-ray studies for X-rays below 4 keV .... See Entry 65801

Mass spectrometry of high pressure arcs in air and SF_6 .... See Entry 66766

Altered glasses: surface analysis study .... See Entry 67319

Identification of pentachlorobiphenyl isomers by application of diffuse reflectance Fourier transform infrared spectroscopy .... See Entry 68186

An investigation of Auger electron signal as a function of sample and detector angles .... See Entry 68370

RBS microscopic 'tomography' .... See Entry 68385

Composition control in proton-exchanged $LiNbO_3$ .... See Entry 68421

Analytical investigation of the precipitation of nitrides in steel .... See Entry 68544

X-ray diffraction quantitative analysis of the Heusler alloy $CU_{2.00}Mn_{1.00}Al_{1.00}$ annealed at temperatures between 423 and 973K .... See Entry 68546

Investigation of phosphosilicate glass layers by partial etching .... See Entry 68672

AES study of the low-pressure oxidation of Si(100): electron beam effects .... See Entry 68678

An optical emission spectrographic method for the determination of niobium in steels .... See Entry 68707

Electron spin resonance of spin-trapped radicals in γ-irradiated aqueous uracil solutions. Chromatographic separation of radicals .... See Entry 68786

Monitoring aerosol elemental composition in particle size fractions in case of long-range transport .... See Entry 68913

Element-sensitive computed tomography with fast neutrons .... See Entry 69002

Application of low energy proton beam for determination of elemental composition in healthy and pathological tissues .... See Entry 69068

PIXE using cyclotron and lung cancer pathogenesis .... See Entry 69069

PIXE analysis of human hair samples .... See Entry 69070

Application of PIXE analysis to neurological diseases .... See Entry 69071

A comparison of PIXE and flame atomic spectrometry for hair analysis .... See Entry 69072

Ion beam analysis of scalp hair as a monitor of occupational exposure .... See Entry 69073

The determination of platinum in human tissues with PIXE .... See Entry 69074

Trace element distribution at the subcellular level—possible correlation between zinc and mRNA .... See Entry 69075

Multi-element analysis of small biological samples .... See Entry 69076

Density distribution of the flux of delayed fission neutrons in water .... See Entry 69386

82.90 OTHER TOPICS IN PHYSICAL CHEMISTRY

Relativistic effects on chemical properties .... See Entry 64635

86.00 ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE

86.10 ENERGY RESOURCES AND THEIR UTILISATION

(inc. economic aspects; for nuclear engineering and nuclear power studies, see 28.00)

86.10B Fossil and other fuels

68842 Lignite (brown coal)—an important energy source at present and in the future. W.Retschke, E.Hildebrandt.
Energietechnik (Germany), vol.33, no.4, p.123-6 (April 1983). In German.
In East Germany about 60% of brown coal production is used for electricity generation and space heating, but efforts are being made to use this fuel for the production of gas and derivation of chemicals. The geological aspects of brown coal mining are surveyed. The importance of close monitoring of ash and water content when this type of coal is to be used in a power station is stressed. Because of the high combustion rate in large power stations it is most important to secure the ease and continuity of flow of materials involved in electricity generation i.e. fuel, ash, water etc., to arrange for facilities to collect and analyse representative coal samples and to remove deposits from boiler tube surfaces by water lancing or other means. To increase the overall economy of power production further uses for coal ash, in addition to the present ones which amount to about 32% of the total ash quantity, should be found. (7 refs.) *G.R.S.*

Exploitation of the riches of the sea .... See Entry 68848

High-temperature process heat for coal gasification by nuclear means .... See Entry 68857

The market potential of the high-temperature reactor .... See Entry 68858

High-temperature process heating for thermo-chemical hydrogen fission .... See Entry 68901

86.10D Wind energy

68843 Possible advances in electrical energy production using wind energy and secondary cells. E.Barendrecht (Tech. Hogeschool Eindhoven, Eindhoven, Netherlands).
Elektrotechniek (Netherlands), vol.61, no.3, p.174-8 (March 1983).
If the penetration degree of electrical energy, produced from wind energy, into the electrical grid, exceeds a certain percentage, then storage is necessary. Possible systems are: pumped hydro energy storage, compressed air energy storage and advanced batteries. Advanced batteries offer certain advantages (fast response, modular system, high energy efficiency and high energy and power density) over other systems. The most promising one in this respect is the sodium/sulphur battery, of which cycle life and costs has been considerably increased, respectively lowered, last years. A systems approach must ultimately be decisive for the final choice. (9 refs.)

68844 Wind power systems and their feasibility in Hong Kong. S.Lingard, W.H.Cheng.
Hong Kong Eng., vol.11, no.2, p.51-7 (Feb. 1983).
Recent studies have indicated that wind energy can make a significant contribution towards supplying energy requirements in regions where sufficiently strong winds occur and in regions which are remote from the main power lines. The advantages of the use of wind as an alternative energy source are the renewable nature of the energy flux and the absence of harmful secondary effects. However, these are frequently more than offset by the many drawbacks, particularly the low power density and the intermittency of the wind. The contents of this article comprise some of the results of a study on the current status of wind power and the possibility of its being harnessed in Hong Kong, stimulated by a curiosity about a traditional source of mechanical power and its potential for the future. (13 refs.)

68845 Numerical study of the performance of tornado-type wind energy systems. S.S.Ayad (Mech. Engng. Dept., Faculty of Engng., Shoubra, Cairo, Egypt).
J. Energy (USA), vol.7, no.2, p.134-40 (March-April 1983).
The tornado-type wind energy system was proposed to utilize the pressure drop created by an intense vortex in a tower. The tower serves as a low pressure exhaust for the turbine. The author carried out a numerical solution of the tower flow, using the two-equation (κ-ε) turbulence model, for the small size system tested by Yen, with a 0.127-m- (5-in.-) diam. tower standing in a uniform wind flow. A comparison of the results with the measured pressure values verified the model. In the present work the same numerical model is used for a system with a tower that is completely embedded in an atmospheric boundary layer. The results show, for a tower in a boundary layer of the one-seventh power-law profile, about a 28% reduction of power coefficient from those for a tower in a uniform stream. Calculations for the performance of a system with different tower heights and the same tower and turbine diameters show a sharp decrease of power for $H/D \leq 0.5$. Analysis of the tangential velocity shows that the vortex should be maintained up to heights $z/D \leq 0.9$ to avoid the decrease in power extraction. Numerical predictions are made for systems with tower diameters between 0.5 and 8 m (1.64 and 26.64 ft) using the same system geometry and approach flow conditions. The results show that the scale effect is negligible for systems of 4-m tower diameter or larger. (11 refs.)

68846 A recursive wind data scaling algorithm. N.D.Sadanandan (Tennessee Valley Authority, Chattanooga, TN, USA), M.Sendaula, D.W.Hilson, M.E.Needham.
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.462-4
Discusses a recursive wind data scaling algorithm developed to scale up wind data collected from various points over a large region. This algorithm maintains the appropriate spectral density content while preserving the temporal and spatial diversity of the wind data. This scaled up wind data was required in the synthesis and analysis of aggregate hourly generation from wind energy conversion systems (WECS), over a region the size of the Tennessee Valley, as a function of mean wind speeds. (3 refs.)

86.10F Tidal and flow energy

(inc. water-wave energy)

68847 Energy resources and vectors in West Africa. L.Gillon (Univ. Catholic de Louvain, Louvain, Belgium).
Bull. Sci. Assoc. Ing. Electr. Inst. Electrotech. Montefiore (Belgium), vol.95, no.3, p.106-17 (July-Sept. 1982). [received: March 1983]
Main energy resource of Central Africa is represented by hydraulic energy. However, the exploitation of this wealth supposes not only building power stations and related facilities, but also the construction of a large network of electrical energy transport. Moreover, large scale interconnection would allow harmonization of product of various sites whose peak production periods are shifted in time depending on climatic local cycles. Construction of such a project should be realized progressively and taking into account development depending on local distribution network extension. After having done an inventory of what already exists, the author sets forth a five-stage plan which would finally lead to creation of a very long high voltage line from Zaire to Senegal. This line would moreover complete a long electrical axis Zaire-Zambia-Zimbabwe already in the process of being built. A good opportunity therefore offered to Africa to promote an Electrical Energy Common Market which would lead, without any doubt, to promotion of the development of a large area of this continent. (no refs.)

68848 Exploitation of the riches of the sea.
Ingenieur (Netherlands), vol.95, no.4, p.16-21 (April 1983). In Dutch.
A recent study by a Netherlands scientific foundation has been examining the role which that country might play in the exploitation of marine resources. The results of the study are analysed and detailed attention is given to potential future areas of development such as tidal power stations, oil drilling, mineral extraction where Dutch marine experience could be profitably utilized. (no refs.) *R.S.*

68849 Hydroelectric power in China. H.Dickinson, I.M.Flanagan, H.W.Whittington (Dept. of Electrical Engng., Univ. of Edinburgh, Edinburgh, Scotland).
Seventeenth Universities Power Engineering Conference, Manchester, England, 30 March-1 April 1982 (Manchester, England: Univ. Manchester Inst. Sci. Technol. 1982), 6 pp.
The capacity and generation potential of China's rivers are reviewed and the history of large and small hydropower projects is surveyed. (25 refs.)

86.10H Geothermal energy

68850 Numerical simulation of subsurface energy storage problems. P.S.Huyakorn, D.E.Dougherty, C.R.Faust (GeoTrans Inc., Reston, VA, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.296-9, vol.2
In recent years the concept of seasonal storage of thermal energy in aquifers has received increasing attention. Several field experiments and numerical simulations have been conducted to determine the feasibility and economic viability of storing heated water or chilled water in selected aquifer systems. The authors describe the formulation of a quasi-three-dimensional finite element model developed to solve the governing equations for subsurface flow and energy storage problems and to present the model application to field data collected from the Stony Brook test site. (8 refs.)

86.10K Solar energy

68851 Efficiency of luminescence in luminescent solar concentrators. A.Lempicki (GTE Labs. Inc., Waltham, MA, USA).
Appl. Opt. (USA), vol.22, no.8, p.1160-4 (15 April 1983).
The power efficiency of luminescence excited by solar radiation in luminescent solar collectors is calculated for a glass sheet doped with Cr^{3+}. The achievable chemical potential for an optically thick absorber irradiated by diluted blackbody radiation as a function of Cr^{3+} concentration, sheet thickness, sunlight dilution, and luminescence quantum yield leads directly to overall conversion efficiency of solar power to luminescence power. (15 refs.)

68852 Transient analysis of a natural circulation solar water heater with a heat exchanger. M.S.Sodha, S.N.Shukla, G.N.Tiwari (Indian Inst. of Technol., New Delhi, India).
J. Energy (USA), vol.7, no.2, p.107-11 (March-April 1983).
This paper presents a transient analysis of the performance of a solar water heating system with a natural circulation of hot water between the collector and the insulated storage tank. Provision for hot water delivery for domestic/industrial uses has been made through a heat exchanger placed in the storage tank. Explicit expressions for the mean system and water delivery temperature obtained in this paper are simpler and more straightforward than those obtained numerically by Tzafestas et al., using a finite difference method, who also define an artificial heat transfer coefficient. This paper further investigates the effect of the exchanger length on the performance of the system and may help a designer to properly size the heat exchanger. Numerical calculations have been made for a typical cold day (Jan. 26, 1980) at Delhi for two modes of hot water withdrawal, namely the constant flow-rate mode and the constant water delivery temperature mode. (15 refs.)

68853 Fluorescent solar concentrators using liquid solutions. A.Filloux, J.Mugnier, J.Bourson, B.Valeur (Conservatoire Nat. des Arts et Metiers, Paris, France).
Rev. Phys. Appl. (France), vol.18, no.5, p.273-9 (May 1983).
Various aspects of fluorescent solar concentrators using liquid solutions of organic dyes are considered. No significant difference in efficiency is observed between various collector geometries. The origins of light losses are carefully examined. A method is proposed for separating the relative contribution of the dye and the matrix in the total attenuation of light. Special attention is paid to light losses by imperfect multiple reflections and by reabsorption of fluorescence photons. Attenuation lengths in collectors using a thin layer of concentrated solution are significantly longer. (20 refs.)

68854 Statistical approach to long-term performances of photovoltaic systems. B.Bartoli, U.Coscia, V.Cuomo, F.Fontana, V.Silvestrini (Istituto di Fisica, Facolta di Ingegneria, Univ. di Napoli, Napoli, Italy).
Rev. Phys. Appl. (France), vol.18, no.5, p.281-5 (May 1983).
The authors propose an analytical model able to describe long-term performances of a photovoltaic system. Such a model relates efficiency of the system with the more meaningful variables involved in the problem: system sizes and meteorological parameters. Furthermore they study the reliability of the model and the limits of its usefulness. (4 refs.)

68855 Modelling and simulation of a field of heliostats reflecting direct solar radiation onto a fixed target. J.C.Hennet (Lab. d'Automatique et d'Analyse des Systemes, CNRS, Toulouse, France).
Rev. Phys. Appl. (France), vol.18, no.5, p.287-93 (May 1983). In French.
The author presents analytical models used to simulate and to evaluate fields of focusing heliostats. For each single heliostat, flux density calculations are performed through a direct integration of a simplified convolution product. Then, shadow effects are analytically computed and individual flux contributions are summed in order to get the global map of flux on the target. (10 refs.)

68856 AM/PM: the rating system for photovoltaic modules. C.F.Gay (ARCO Solar Inc., Chatsworth, CA, USA).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.353-61
The paper defines an approach to straightforward measures and ratings for photovoltaic modules which match the energy user's needs. The rating measurement proposed, that of electric energy delivered (Wh/day), is based on a standard solar day averaged over the year and the world, indexable according to climatological zones. This standard day sees a 24-hour average irradiance of 200 W/m^2, average temperature of 20°C. The required module measurement involves the typical peak-watt power output and sensitivity to temperature, light level, and spectral content. It then becomes possible for the energy user to estimate the cost per kilowatt-hour of electrical energy received over the life of the system. The paper illustrates the concept of and need for energy-based ratings by demonstrating various case calculations for the standard day. One commercial module type rated at 40 peak watts has an AM/PM rating of 194 Wh/day. (4 refs.)

Erstellung und Tests von experimental-Solargeneratoren fur konzentrierende Systeme (Construction and testing of experimental solar generators for concentrator systems) .... See Entry 68874

Recent progress in terrestrial photovoltaic collector technology .... See Entry 68879

Series resistance analysis of concentrator cells under high injection conditions .... See Entry 68892

86.10N Nuclear energy

68857 High-temperature process heat for coal gasification by nuclear means. W.Peters (Bergbau-Forschung GmbH, Essen, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.62, no.12, p.1024-6 (Dec. 1982). In German.
The activities commenced in 1973/74 to make good the expected deficiency between oil and gas supplies on the one hand and demand on the other have stagnated once again. However, increased use of coal and nuclear energy is necessary in the long term. The aims of coal gasification by nuclear means are: to extend coal reserves, to reduce the effects on the environment and to reduce the costs of gas production. The paper describes various concepts of gasification and the status of projects on this process. (4 refs.)

68858 The market potential of the high-temperature reactor. K.Knizia (Vereinigten Elektrizitatswerke Westfalen AG, Dortmund, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.62, no.12, p.1032-6 (Dec. 1982). In German.
It seems urgently necessary to plan the power supplies of the industrial countries in a more flexible fashion and thereby to make them less susceptible to disturbances arising externally through restrictions on fuel deliveries or price increases. The development and introduction of advanced reactors and the further development of coal processing are of prime importance in this respect. This development will lead in the long-term to the production of hydrogen with the use of nuclear energy. (no refs.)

68859 The potentialities of nuclear power engineering in solving the fuel problems. A.S.Kochenov.
Therm. Eng. (GB), vol.29, no.7, p.351-4 (July 1982). Translation of: *Teploenergetika (USSR)*, vol.29, no.7, p.2-5 (July 1982). [received: Feb. 1983]
Tables are presented and discussed showing the division of power station and industrial plant fuel consumption in the USSR between gas, oil and coal; world resources of oil and uranium; characteristics of nuclear fuel and (projected) breeder reactors; and world fuel consumption forecasts for the years 2000 and 2025. (7 refs.)

High-temperature process heating for thermo-chemical hydrogen fission .... See Entry 68901

86.30 ENERGY CONVERSION

86.30E Primary cells

68860 Primary power cells.
Electron. Prod. Des. (GB), vol.4, no.4, p.167-73 (April 1983).
Describes the relative advantages and gravimetric/volumetric energy density of the different cells available. These include zinc carbon, alkaline manganese, mercury, zinc air, lithium, and silver. (no refs.)

68861 A zinc paste primary battery. R.Jasinski, R.McCarron, G.Brilmyer (Occidental Res. Corp., Irvine, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.539-42 (March 1983).
Zinc metal pastes can be electrolytically discharged in a concentrated caustic electrolyte. The ease with which a paste can be pumped is determined by the relative ratios of liquid, zinc, and a smaller particle size phase such as ZnO. These ratios are not arbitrary but are predictable via model based on the packing of spherical particles. The depth of discharge is limited in part by the original liquid content of the paste. (4 refs.)

Ionic conducting glasses of the Li_2S-GeS_2-LiI system. Their use in 'all-solid' generators with lithium anodes .... See Entry 67277

86.30F Secondary cells

68862 A lithium electrode with a zinc substrate for secondary batteries. Y.Matsuda, M.Morita, H.Katsuma (Dept. of Industrial Chem., Yamaguchi Univ., Yamaguchi, Japan).
J. Electrochem. Soc. (USA), vol.130, no.3, p.627-8 (March 1983).
The development of a lithium secondary battery using an organic electrolyte has been actively pursued in recent years. The authors show the charge-discharge characteristics of a Li electrode with a Zn substrate in propylene carbonate (PC) solution containing lithium perchlorate ($LiClO_4$) or lithium

tetrafluoroborate ($LiBF_4$). The results are briefly discussed by comparing the characteristics with those obtained on an Al substrate. (13 refs.)

68863 Plastic battery. K.Kaneto.
Solid State Phys. (Japan), vol.17, no.12, p.753-8 (Dec. 1982). In Japanese. [received: April 1983]
Electrochemistry of conducting polymers and the characteristics of a light weight, rechargeable stage plastic (polyacetylene) battery are described. (11 refs.)

Electric field enhanced diffusion in trans-(CH) .... See Entry 67295

Possible advances in electrical energy production using wind energy and secondary cells .... See Entry 68843

Matching the characteristics of batteries with solar cell modules .... See Entry 68876

Calculation to improve power conversion efficiency in photovoltaic systems .... See Entry 68877

86.30G Fuel cells

68864 Fuel cells for electricity generation. M.Alfenaar.
Elektrotechniek (Netherlands), vol.61, no.3, p.161-5 (March 1983).
The principles of operation of different types of fuel cells are given. Specific advantages and problems are sketched. From the data it appears that phosphoric acid fuel cells have already reached the same efficiency for electricity generation as the best conventional power plants. (no refs.)

Structure of indium tin oxide electrodes on zirconia .... See Entry 67411

86.30J Photoelectric conversion: solar cells and arrays

68865 Proposing a new backward solar cell. K.K.Govil.
Electron. Lett. (GB), vol.19, no.10, p.395-7 (12 May 1983).
The author proposes a new backward solar cell. The reason for calling it backward is because under dark conditions it behaves as a backward diode. The main advantage of this solar cell is the higher open-circuit voltage compared to the currently used *p-n* solar cell. (12 refs.)

68866 Recent progress in amorphous silicon solar cells. Y.Uchida, H.Sakai, T.Ichimura, M.Nishiura, H.Haruki (Fuji Electric Co. Ltd., Tokyo, Japan).
Fuji Electr. Rev. (Japan), vol.28, no.4, p.116-22 (1982).
Reports on the progress of development work by Fuji Electric into commercial amorphous silicon solar cells. (10 refs.)

68867 Calculation of the efficiency of a polycrystalline gallium arsenide thin film solar cell. K.Sen, R.S.Srivastava (Dept. of Phys., DBS Coll., Dehradun, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.818-20 (Oct. 1982). [received: April 1983]
An important effect of grains in polycrystalline solar cells is to reduce the diffusion length of carriers and hence increase the dark current and decrease the short circuit current, ultimately lowering the efficiency of the cell. The authors present a simplified theory and calculations which show that efficiency for a 2 μm base thickness (H) GaAs solar cell may be of the order of 14% for grain size (D) of 10 μm. With $D>H$, the dominant current mechanism at open circuit voltage is majority carrier tunnelling, whereas for $D<H$ it is a grain-grain depletion region recombination current. (10 refs.)

68868 A flux analysis of the current-voltage characteristics of thin film frontwall illuminated and backwall illuminated liquid junction and metal junction solar cells. S.Hinckley, J.F.McCann, D.Haneman (School of Phys., Univ. of New South Wales, Kensington, NSW, Australia).
J. Appl. Phys. (USA), vol.54, no.4, p.1955-65 (April 1983).
The flux method was used to derive analytical expressions for the photocurrent-voltage characteristics of thin film frontwall and backwall illuminated liquid junction solar cells as functions of film thickness. Expressions for these types of cells were derived without assuming the depletion layer was a minority carrier sink but with inclusion of the effects of depletion and bulk recombination, reflection, and restricted transmission at the semiconductor junction and reflection at the back contact. The effects of film thickness, donor concentration, and of partial reflection and imperfect transmission at the depletion layer/bulk layer boundary are examined. The results from this flux method are qualitatively similar to those obtained previously from different starting equations in the cases where both treatments are applicable, lending support to both approaches. In particular, the short circuit current is shown to be significantly reduced by depletion layer recombination, and by slow charge transfer when depletion layer recombination is not negligible. (29 refs.)

68869 Photovoltage decay in *p-n* junction solar cells including the effects of recombinations in the emitter. S.C.Jain, U.C.Ray (Solidstate Phys. Lab., Delhi, India).
J. Appl. Phys. (USA), vol.54, no.4, p.2079-85 (April 1983).
The expressions for the open circuit photovoltage decay in a *p-n* junction solar cell are derived, including the efects of recombinations in the emitter. It is shown that for a cell with base thickness $w_B \gg L_B$, the base diffusion length, the voltage decay rate for small values of time depends on the emitter dark saturation current J_{EO}; the larger the value of J_{EO}, the faster is the initial rate of voltage decay. For large values of time, the rate of voltage decay is solely determined by the minority carrier lifetime in the base τ_B and is independent of J_{EO}. However, for a cell with $w_B \lesssim L_B$, the voltage decay is linear from the very beginning and the decay rate is of the form $(kT/e)[(1/\tau_B)+(1/t_1)]$. The time constant t_1 is independent of τ_B. It, however, depends on the base thickness, the effective back surface recombination velocity, and the emitter dark saturation current J_{EO}. The value of J_{EO} depends on emitter thickness, front surface recombination velocity, drift field in the emitter, band-gap narrowing, and Auger recombinations in the emitter. (24 refs.)

68870 Amorphous silicon photovoltaic modules. Y.Uchida, H.Sakai, N.Furusho, M.Nishiura, H.Haruki (Fuji Electric Corporate Res. & Dev. Ltd., Yokosuka, Japan).
J. Electrochem. Soc. (USA), vol.130, no.3, p.712-16 (March 1983).
In hydrogenated amorphous silicon solar cells of 100 cm^2, the conversion efficiency of more than 6% has been obtained for the cells with metal/n-i-p/ITO/glass and ITO/n-i-p/SS structures under AM1 (100 mW/cm^2) illumination. The module structure and encapsulating materials suitable for a-Si solar cell were investigated to make a low cost module. Typical output power under AM1 illumination is 16 W for the module composed of 40 sheets of ITO/n-i-p/SS cells with 10×10 cm^2 area. The a-Si modules have been tested in various environments. The results show that the a-Si solar cells are highly resistive to high and low temperature, high humidity environments, and thermomechanical stress. (8 refs.)

68871 A survey of knowledge on the theory of MIS solar cells. M.Ruzinsky, V.Saly, S.Baratka (SVT, Bratislava, Czechoslovakia).
Slaboproudy Obz. (Czechoslovakia), vol.44, no.3, p.132-9 (March 1983).
The effects of various parameters namely the thickness of the insulating layer, the output work of the metal layer, the resistivity of the semiconductor, the surface states and the charge in the insulator, the temperature, the illumination, the lifetime of the charge minority carriers, crystallographic orientation and the energy gap on the conversion efficiency of MIS solar cells, are discussed. (20 refs.)

68872 Recent development on amorphous solar cells. S.Nitta.
Solid State Phys. (Japan), vol.18, no.1, p.52-6 (Jan. 1983). In Japanese.
Recent progress on amorphous semiconducting solar cells is reviewed from the standpoint of solid state physics. (24 refs.)

68873 Etude du couplage et de la protection des panneaux solaires a cellules photovoltaiques en vue d'obtenir de hauts voltages en courant continu (Study of the connection and protection of photovoltaic cell solar panels in view of obtaining high voltages in continuous currents). F.Forge.
Report EUR 8143 FR, Comm. European Communities, Luxembourg (1982), 43 pp. In French. Contract 718-78-12 ESF.
The objective was to establish, from measurements on real cells, a statistical distribution of the breakdown voltages of shaded cells, and hence to determine from network simulation the magnitudes of the unbalance liable to arise in accidental operating conditions (short-circuit, open-circuit and shading), and their consequences for cell behaviour. From these experimental results, various installation and protection schemes have been studied and selected in accordance with reliability and overall installation cost criteria. The results are interpreted and factors influencing inverse characteristics are discussed. The author concludes in favour of a protection diode in series with 36 cells at most.

68874 Erstellung und Tests von experimental-Solargeneratoren fur konzentrierende Systeme (Construction and testing of experimental solar generators for concentrator systems).
Report EUR 8149 DE, Comm. European Communities, Luxembourg (1982), 33 pp. In German. Contract 417-78-1 ES D.
Starting from the results of the BMFT sponsored fundamental research on silicon solar cells for concentrated sunlight, terrestrial photovoltaic experimental generators have been designed, developed and built which are suitable for integration into a 'hybrid system'. The hybrid system comprising MAN's concentrating collectors HELIOMAN and AEG-Telefunken's photovoltaic generators renders possible the system test of interacting components, which are known from separate operation. (12 refs.)

68875 Optimizing the operation of a photovoltaic generator. C.Boisvineau, J.Perard, E.Olivier (Lab. d'Electrotech., Inst. Nat. Polytech. de Grenoble, Grenoble, France).
Seventeenth Universities Power Engineering Conference, Manchester, England, 30 March-1 April 1982 (Manchester, England: Univ. Manchester Inst. Sci. Technol. 1982), 6 pp.
Explains how to optimize the operation of a photovoltaic generator supplying a DC load through a transistor chopper. The authors present the conception of the chopper as an adaptor and a first approach to the optimal operating point, and the systematic search for the optimal operating point by a maximum power point tracking device with experimental checking of the process. (3 refs.)

68876 Matching the characteristics of batteries with solar cell modules. C.F.Gay, V.K.Kapur, B.Pyle, J.Rumburg (ARCO Solar Inc., Chatsworth, CA, USA), A.Manfredi.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.335-9
The paper puts together the characteristics of the storage battery commonly used in worldwide photovoltaic applications with those of the photovoltaic generator and of the solar source. The natural matching of these characteristics may be exploited in meeting the typical requirements of the user. If the module is properly designed, and if due care is taken in battery installation for passive temperature control, there is no need for complex regulation or periodic adjustment. A well-designed photovoltaic module can function as both generator and controller, providing enhanced system reliability, lower system cost, and simpler operation for the user. The critical design parameter, the charging voltage delivered to the battery by the module, is determined by the number of cells in the series string. (2 refs.)

68877 Calculation to improve power conversion efficiency in photovoltaic systems. A.Mas, J.Garcia, L.Closas, M.Insausti, L.Castaner (ETSITB, Barcelona, Spain).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.340-4
The paper deals with several photovoltaic system configurations in order to improve the adaptation between a photovoltaic panel and an AC load, in low power applications. Panel to battery and battery to AC load interfaces are considered and their efficiencies evaluated for each configuration. Several values of the system main parameters as battery voltages, nominal output power and others are also considered. Experimental results indicated that the panel to battery interface efficiency is substantially improved by inserting an adaptative battery interface (ABI). The behaviour of the battery to load interface for the configurations proposed is analysed. (4 refs.)

68878 Flat plate module technology—overview. E.Fabre (Photowatt Internat. SA, Rueil-Malmaison, France).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.346-52
The paper presents a synthetic overview of the different technologies which can be used for manufacturing a photovoltaic module. The emphasis is stressed on the cost aspect. The whole process is divided in three steps: (i) material preparation and shaping, (ii) cell processing and (iii) cell interconnection and encapsulation. The present state of the art and the general technical trends for the next few years are presented and discussed for each step, in the frame of the silicon technology. The respective contributions to the total cost are also discussed, in view of defining the general orientations for R&D which have to lead to drastic cost reduction. Once all these steps have been individually reviewed it is important to investigate the technical compatibility between all the different possible technologies in order to build up an economic and consistent process. (no refs.)

68879 Recent progress in terrestrial photovoltaic collector technology. R.R.Ferber (Photovoltaics TD&A Lead Center, Jet Propulsion Lab., Pasadena, CA, USA).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.364-8
The US Department of Energy's photovoltaics program has as a goal the development of economic photovoltaic systems for terrestrial applications. A key element of a photovoltaic system is the collector, which converts the solar energy to electrical energy. The targeted cost for the collector is \$0.70/W_p (1980\$). Two collector concepts are being developed to meet this cost target: (1) flat-plate by the Jet Propulsion Laboratory Flat-Plate Solar Array Project, and (2) concentrator by the Sandia Laboratories. The achievement of the cost target is dependent upon the Technical Feasibility demonstration of a number of different R&D areas in coordination with industry. The current Administration R&D policy changes have impacted the program direction; however, the advances in both flat-plate and concentrator technology support the conclusions that collector R&D objectives are attainable. (no refs.)

68880 Low-cost solar array progress and plans. W.T.Callaghan (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.369-73
The flat-plate solar array project (FSA), sponsored by the US Department of Energy (DOE) and managed by the Jet Propulsion Laboratory, has achieved considerable technical progress since that reported at the Third European Communities Conference. The basic technological direction has also changed since then. Progress in the areas of silicon feedstock refinement; large-area sheet formation; flat-plate module process sequence development, and engineering and environmental testing are discussed in the context of a revised thrust developed by DOE toward higher-risk, longer-term-payoff work that emphasizes the assumption of technological risks that industrial firms are not likely to finance in the effort to develop reliable, low-cost photovoltaic modules. (no refs.)

68881 An all glass encapsulation of solar cells using silk-screening techniques. M.C.Michel (Lab. de Marcoussis, Centre de Recherche, Compagnie Generale d'Electricite, Marcoussis, France).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.374-6
The interest and originality of this process is threefold: glass only is used as an encapsulating material, which gives lower cost and higher reliability the making of the front contacts and the sealing of the cells are simultaneous, which reduces the number of operations the process involves a major use of screening techniques which are cheap and can be automated. The main part of the work deals with the bonding of the cells to the glass sheet. The author made modules of one or six cells. The study involves: the study of a sealing glass with mechanical, chemical, optical properties fitted to the all glass encapsulation and the fabrication of the screenable paste using this glass; the definition of the process which involves the screening of the sealing glass, the electrical contacts and the electrical connections between the cells, and which makes these three parts compatible. Properties of modules were measured before and after accelerated aging tests: the modules behaved satisfactorily after thermal cycles between −40°C and +90°C and humid conditioning cycles. Measurements of the electrical properties of encapsulated cells still show some scatter, nevertheless yields up to 12% have been achieved. (no refs.)

68882 Laminated modules with new plastic material based on an ethylene-vinylacetate copolymer. A.Desombre, J.Donon (Photowatt Internat. SA, Rueil-Malmaison, France), Y.De Zelicourt, J.C.Bobo.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.377-81
A large scale commercial production of solar modules is based on a sheet lamination process. The polymer predominantly used is a polyvinylbutyral film (PVB). The authors have made a new formulation with a copolymer of ethylene and vinylacetate including several additives. This product is more interesting than PVB for the reasons of cost and thermal properties. The basic steps of encapsulation process involved are listed. The authors have made some experimental modules which are now under long term ageing tests. (2 refs.)

68883 Design and development of a module for the EEC PV pilot plants. A.Muleo, F.Nardi, V.Paraggio (Solaris SpA, Florence, Italy).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.382-6
The modules for intermediate load applications ought to be particularly designed in accordance with higher standards and ad-hoc criteria. The module developed in this work accepts 72 cells either round, 100 mm in diameter, or square, 100 mm by 100 mm. The cells are located in a 6×12 matrix and the connections form 6 parallel strings and 4 series blocks with 3 cells per substring. This particular module delivers a current that is six times the current and a voltage that is twelve times the voltage of a single cell. Parallel interconnections (total of five) run across every substring of three cells in series. There are two main advantages of this module. The first is that it is a high current-low voltage module, better suited for large systems since mismatching problems due to the use of modules in parallel are reduced. The second is the high reliability. The paper discusses reliability, recording the behavior of the module to shadowing, short circuiting of a cell, opening of interconnections, etc. Also the design of the module has been improved by closely matching the antireflection coating to the combination of low iron glass and of encapsulant. Spectral resonse of the cells prior to encapsulation and after paneling are shown. (2 refs.)

68884 Solar cells failure modes and improvement of reverse characteristics. A.M.Ricaud.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.392-8
The growing number of large photovoltaic installations calls attention to the possible development of 'hot spots' leading to a loss of power in the best case. Catastrophic consequences on the whole array can be avoided by particular precautions taken at the cell, panel and system design level. Hot spots problems arise in modules when one or several cells become back biased and operate in the negative voltage quadrant, as a result of short-circuit current mismatch, cell cracking or shadowing. Optimization of system designs with diodes protections has already been demonstrated by France-Photon in a previous paper (1981). Further to the industrialised matching of the cells in the same module, an important result of this study is that one can improve the capability of dissipating reverse power by decreasing the shunt resistance with negligible sacrifice of the direct peak power. After a complete study of the dark direct current, the author shows for basic technology that the main parameter which governs the slope of the reverse characteristic is the shunt resistance and indicate trends to understand its fundamental causes and their relative weight for single and semicrystalline cells. (5 refs.)

68885 Fabrication on large area Cu_2S/CdS thin film solar modules. H.Huschka, B.Schurich, J.Worner (NUKEM GmbH, Hanau, Germany).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.399-403
Thin film photovoltaic generators based on the heterojunction system Cu_2S/CdS are the most developed alternative to Si solar cells. The results and experience obtained prove the Cu_2S/CdS cell to be a stable and highly reliable element with good conversion efficiencies. To demonstrate the feasibility of a large scale production a pilot plant was built by NUKEM. Most conventional methods and techniques are used for this line. It is expected that such a generator could reach the price goal which was defined for economic operations. (no refs.)

68886 Front contacts for large area high efficiency Cu_2S-CdS solar cells. W.Arndt, H.W.Schock (Inst. fuer Phys. Elektronik, Univ. Stuttgart, Stuttgart, Germany).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.404-8
Cu_2-S-CdS thin film solar cells have been fabricated by evaporating CdS onto metallized glass substrates and by forming the Cu_2S layer topotactially by a wet dip process in a solution of CuCl. The front contact is formed on the cover glass by silk screen printing, etching and electroplating techniques. The Cu_2S is contacted and encapsulated by sticking the front contact onto the Cu_2S and sealing it at high pressure and elevated temperature. Two different techniques have been used to produce the front contact: (1) A Cu foil is laminated to the cover glass by means of a hot sealing adhesive. Employing silk screen printing, etching and electroplating, the complete grid is fabricated. (2) Contact lines are directly vacuum deposited into the Cu_2S-film. The lines can be obtained employing either an aperture mask or lift-off photolithography. Bus bars are provided by the cover glass, where they have been produced according to (1). (7 refs.)

68887 Gas immersion laser diffusion: a new method for making efficient Si solar cells. G.B.Turner, D.Tarrant, D.Aldrich (ARCO Solar Inc., Chatsworth, CA, USA), R.Pressley, R.Press.
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.427-31
A new method for making both p^+/n and n^+/p junction solar cells is described. A Si wafer is immersed in a transparent dopant gas and irradiated with a pulsed alexandrite laser (0.73 μm). The surface of the wafer melts for less than a microsecond and dopant from the gas is dissolved in it before epitaxial regrowth. There is no implant or deposition step and no photolysis is required so a UV laser is not needed. the technique is termed GILD, an acronym for gas immersion laser diffusion. Using PH_3 or B_2H_6 dopant, junctions were formed in 3×3 mm squares by single 200 ns, 2 J cm^{-2} pulses. By repeating the pulses at a 10 Hz rate and stepping the substrate between pulses, large areas were treated and 2×2 cm solar cells cut from them. Efficiencies of 9.2% for both p^+/n and n^+/p cells have been achieved without antireflection coating or back surface fields. The process is simple and rapid and offers significant advantages for cell production, including elimination of back etch and masking. Substrates are not heated except at the surface. (4 refs.)

68888 Study of the grain boundary effects in N-P junction polycrystalline Si solar cells. N.C.Halder (Dept. of Phys., Univ. of South Florida, Tampa, FL, USA).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.437-42
The effects of grain boundary, such as recombination velocity, grain size, and grain orientations, have been studied on the efficiency of n-p junction polycrystalline Si solar cells. Numerical calculations have been made for the photocurrent, dark current and fill factor utilizing previously developed theory in three dimensions. The results of this study indicate that it is possible to produce an efficiency as high as 15% with fibrously grained samples of grain size 100 μm, recombination velocity 100 m/sec, and thickness 100 μm. (7 refs.)

68889 Recent advances in ITO/InP and Cds/InP solar cells. T.J.Coutts, N.M.Pearsall (School of Phys., Newcastle upon Tyne Polytech., Newcastle upon Tyne, England).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.459-63
Solar cells based on single crystal p-type indium phosphide (InP) have been fabricated by RF sputter deposition of either indium tion oxide (ITO) or cadmium sulphide (CdS). In an effort to determine the nature of these devices, the J-V characteristics have been measured and analysed under various conditions of illumination and temperature. Values of the reverse saturation current. J_o, and its activation energy have been obtained. These suggest that there may be a fundamental mechanism which limits the efficiency of ITO/InP heterojunctions to less than 10%. However, there is great potential for junctions to less than 10%. However, there is great potential for the CdS/InP cells. The variation of the quantum efficiency of the cells with wavelength has also been measured. The analyses clearly show that the substrate preparation procedure dominates cell behaviour. (2 refs.)

68890 Non linear model for shunt current in terrestrial silicon solar cells. J.Cabestany (ETS Ingenieros de Telecomunication, Barcelona, Spain).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.498-502
The circuit models commonly used for the I(v) characteristics in order to determine the equivalent circuit parameters of a solar cell fail when terrestrial textured surface solar cells are concerned with high percentage of metal covered area. Two alternatives are proposed, first is an empirical approach in which a parameter will be considered non constant and the second alternative is to include a new exponential term in the I(v) characteristic. (3 refs.)

68891 Non-linear increase and decrease of open circuit voltage of n^+-p-p^+ silicon solar cells at high illumination level. C.M.Singal, R.V.Singh (Energy Centre, Dept. of Phys., Univ. of Roorkee, Roorkee, India).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.503-10
The photovoltaic power conversion efficiency as well as the total power generation from a silicon solar cell can be increased by operating it under

concentrated sunlight. The increase of the efficiency results from an increase in the open circuit voltage of the cell under concentrated sunlight. Additional enhancement of this voltage is predicted through low high p-p^+ junnction in a solar cell haying an n^+-p-p^+ configuration. The evaluation of the voltages across the n^+-p junction (V_j) and p-p^+ junction (V_h) have been done in a self-consistent manner since the carrier concentrations and their flow in the n^+, p and p^+ regions are coupled, to one another. Further as has been recently shown by Lanyon and Tuft that there is an energy band gap shrinkage which is directly dependent upon the concentration of mobile carriers, and not on the doping concentration alone, the authors expect significant modifications in the open-circuit voltage of the cell at high illumination levels. The present analysis has been carried out incorporating the above requirements, and the developed voltages V_j, V_h and Dember potential (V_D) as well as their total voltage V_{oc}, under open-circuit conditions, have been determined for illumination levels ranging from 10^{-10} to 10^8 suns for the purpose of investigating the onset, linearity, saturation and decrease of these voltages under different illumination conditions. (9 refs.)

68892 Series resistance analysis of concentrator cells under high injection conditions. J.M.Ruiz, M.Cid, A.Vuevas, A.Luque (Inst. de Energia Solar, Univ. Politecnica Madrid, Madrid, Spain).
Fourth E.C. Photovoltaic Solar Energy Conference. Proceedings of the International Conference, Stresa, Italy, 10-14 May 1982 (Dordrecht, Netherlands: Reidel 1982), p.511-15
Two analytical models for low and high-injection levels, respectively, and an exact model for variable injection level are used to analyze the performance of silicon solar cells with either low or high base resistivity under concentration. The ranges of applicability of the two analytical models are determined by comparison with the exact model. Specially interesting is the very good agreement observed between the exact model and the high-injection one, because both are new and constitute a simplification of previous theories. The theoretical results are that a high resistivity of the base region does not degrade the performance of the cell even at high concentration levels and that a low resistivity cell and a high resistivity cell have similar efficiencies. Experimental results are included that agree qualitatively with the theoretical predictions. (7 refs.)

68893 Passive and enhanced grain boundaries in solar cells by gas immersion laser diffusion. G.B.Turner, D.Tarrant, D.Aldrich (ARCO Solar Inc., Chatsworth, CA, USA), R.Pressley, R.Press.
Grain Boundaries in Semiconductors. Proceedings of the Materials Research Society Annual Meeting, Boston, MA, USA, Nov. 1981 (New York, USA: North-Holland 1982), p.241-6
A new method for making p-n junctions based on immersion in a transparent dopant gas followed by irradiation with a pulsed laser is presented. The surface of the wafer melts, dopant from the gas dissolves in it, and is distributed by liquid diffusion before epitaxial regrowth. This technique, termed GILD for Gas Immersion Laser Diffusion, was used to make solar cells in both monocrystalline and polycrystalline silicon. Laser photocurrent scanning shows that grain boundary recombination is reduced or eliminated in cells made by the GILD technique and current collection is enhanced at some grain boundaries. Heat treatment at 850°C prior to GILD causes the same grain boundaries to be recombination active as they are in ordinary diffused cells. (3 refs.)

68894 Accelerated reliability testing of encapsulated solar cells. F.White, J.W.Lathrop (Clemson Univ., Clemson, SC, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.453-6
Various types of encapsulation systems with electrically biased solar cells were subjected to an environment of 85°C and 85% relative humidity. The encapsulation systems have been categorized into three groups: bare cells, hermetic substrates, non-hermetic substrates. The non-hermetic substrates degraded worst while the hermetic substrate cells degraded least. The measurement techniques and one test used to determine reliability are discussed. The results of the test are then used to analyze a possible degradation mechanism. (4 refs.)

Solid solubility and precipitation of phosphorus and arsenic in silicon solar cells front layer .... See Entry 67226

Studies of the gap states density in undoped and doped amorphous hydrogenated silicon .... See Entry 67545

Pulsed electron beam annealing of ion implanted germanium for photovoltaic devices .... See Entry 67774

Effect of various plasmas on vacuum deposited amorphous and microcrystal silicon .... See Entry 68441

Optical and electrical properties of amorphous silicon films prepared by photochemical vapor deposition .... See Entry 68448

Studies on polycrystalline silicon for solar applications, including characterization of trace elements B, C and Al by charged particles activation analysis .... See Entry 68835

Efficiency of luminescence in luminescent solar concentrators .... See Entry 68851

Fluorescent solar concentrators using liquid solutions .... See Entry 68853

Statistical approach to long-term performances of photovoltaic systems .... See Entry 68854

AM/PM: the rating system for photovoltaic modules .... See Entry 68856

86.30K Photoelectrochemical conversion

Structural and compositional characterization of mixed CdS-CdSe films grown by cathodic electrodeposition .... See Entry 67397

Photoelectrochemical study of TiNi alloy oxide layer .... See Entry 67776

A flux analysis of the current-voltage characteristics of thin film frontwall illuminated and backwall illuminated liquid junction and metal junction solar cells .... See Entry 68868

86.30L Electrogasdynamic and magnetohydrodynamic conversion

(see also 52.75 Plasma devices and applications)

68895 Experimental study of the heat fluxes in a MHD channel. B.S.Petukhov, A.V.Karpukhin, V.V.Kirilov, A.I.Plavinskii, A.F.Polyakov, V.D.Semenov, Yu.N.Sokolov, Yu.V.Tsypulev (High-Temperatures Inst., Acad. of Sci., USSR).
High Temp. (USA), vol.20, no.4, p.617-22 (July-Aug. 1982). Translation of: *Teplofiz. Vys. Temp. (USSR)*, vol.20, no.4, p.738-44 (July-Aug. 1982). [received: April 1983]
Results are presented on the local heat fluxes in the channel of the U-25B MHD generator. The design of the channel is described along with the methods of making the measurements. Data have been obtained on the distribution of the heat fluxes at various parts of the channel under conditions of strong electromagnetic interaction. The effects of various factors characteristic of MHD channels are examined.

End effect in segmental channel .... See Entry 66763

Experimental study of conduction-type MHD-channel operating with electrolyte .... See Entry 66764

86.30M Thermoelectric conversion

68896 Temperature distribution in anisotropic thermoelements. A.G.Samoilovich, O.Yu.Shevchuk (State Univ., Chernovtsy, USSR).
Sov. Phys.-Semicond. (USA), vol.16, no.11, p.1260-2 (Nov. 1982). Translation of: *Fiz. & Tekh. Poluprovodn. (USSR)*, vol.16, no.11, p.1951-4 (Nov. 1982). [received: April 1983]
A method is developed for the determination of the temperature distribution in anisotropic thermoelectric generators and cooling units made of materials with temperature-independent transport coefficients and subjected to a constant internal electric field. This makes it possible to study more fully the energetics of such devices. The results are given of a calculation of the distribution of the Bridgman heat and of eddy thermoelectric currents in an anisotropic thermoelectric generator. (6 refs.)

86.30Q Chemical energy conversion

(for electrochemical conversion, see 86.30D; for photoelectrochemical conversion, see 86.30K)

68897 Metal oxidation as a heat pump. D.Cubicciotti (Electric Power Res. Inst., Palo Alto, CA, USA).
J. Electrochem. Soc. (USA), vol.130, no.3, p.729-30 (March 1983).
The oxidation of a metal is generally an exothermic process, and the rate of heat release is slow enough in most cases that the detailed location of the site of heat evolution is not important. During a rapid oxidation, however, it is interesting to consider the detailed processes of heat generation. During the rapid oxidation of zirconium, there should be a temperature gradient through the thickness of the oxide. The metal side should be cooler than the gas side of the oxide. If the zirconium were in a fast flowing stream of gas which could effectively remove the heat pumped through the oxide layer to the oxide-gas surface, then the substrate metal would be cooled by the oxidation process and the temperature of the metal would fall below its initial value. (5 refs.)

86.30R Thermal energy conversion (heat engines and heat pumps)

68898 High-temperature heat pump. R.Pitt (Lehrstuhl & Inst. fur Dampf- & Gasturbinen, Rheinisch-Westfalischen-Tech.-Hochschule, Aachen, Germany).
Brennst.-Waerme-Kraft (BWK) (Germany), vol.35, no.1-2, p.30-5 (Jan.-Feb. 1983). In German.
In order to produce liquid or gaseous chemical raw materials and fuels from coal and water, process heat must be employed. The temperature in the described heat pump is increased by addition of electrical energy. The effects of its application on the steam-coal-gasification process and on the process of water decomposition, namely high-temperature steam phase electrolysis, are introduced. The principle of the high-temperature heat pump and examples of application and necessary development efforts are discussed in detail. (10 refs.)

Metal oxidation as a heat pump .... See Entry 68897

86.30S Photothermal conversion

Thermodynamics of daylight-pumped lasers .... See Entry 66250

TSC study of morphological modifications of rhodamine coloured PMMA .... See Entry 67638

Stick-on cobalt oxide selective coatings for solar thermal applications .... See Entry 68435

86.40 ENERGY STORAGE (SECONDARY ENERGY)

86.40F Storage in thermal energy

Numerical simulation of subsurface energy storage problems ..See Entry 68850

86.40H Storage in chemical energy

68899 Stored chemical energy propulsion system for underwater applications. T.G.Hughes, R.B.Smith, D.H.Kiely (Pennsylvania State Univ., University Park, PA, USA).
J. Energy (USA), vol.7, no.2, p.128-33 (March-April 1983).
An underwater propulsion system that couples a lithium fuelled boiler with a standard Rankine cycle has been developed and demonstrated in an ocean environment. Although the demonstration vehicle was a small diameter axisymmetric body, other configurations have been subjected to study and experimentation. Various fuel-oxidizer combinations have been considered for use in the system, and these are examined along with the necessary supporting technologies for future development efforts. A brief history of the system development is included. It is concluded that the described system has been

shown to be a viable candidate for numerous underwater applications. (15 refs.)

68900 Feasibility assessment of customer-side-of-the-meter applications for battery energy storage. W.J.Stolte.
Report EPRI-EM-2769, Electr. Power Res. Inst., Palo Alto, CA, USA (Dec. 1982), 110 pp.
Available from Res. Rep. Center, Box 50490, Palo Alto, CA 94303, USA.
Describes an investigation of the important techno-economic factors for customer-owned battery energy storage plants. Battery storage system designs and costs are described and quantified, and the most current rates and customer load profiles are used for a range of generic applications to obtain an economic analysis. A baseline application is described and evaluated, and the parametrically varied cost and performance parameters used to determine the sensitivity of the results are discussed.

86.40K Hydrogen storage and technology

68901 High-temperature process heating for thermo-chemical hydrogen fission. K.F.Knoche (Lehrstuhl fur Tech. Thermodynamik, RWTH, Aachen, Germany).
VGB Kraftwerkstech. (German Ed.) (Germany), vol.62, no.12, p.1030-1 (Dec. 1982). In German.
Hydrogen is likely to be the most important energy source in the next century. Numerous investigations have demonstrated the special advantages of hydrogen as a fuel or for a wide range of applications in the chemical industry. At the present time of course the high additional costs in comparison with natural gas outweigh these advantages. First, the application of nuclear power from high-temperature reactors has made hydrogen production economic, Basic research undertaken to date has indicated that thermo-chemical water disintegration processes offer numerous posibilities for improvements in technical processes. (no refs.)

68902 Water electrolysis for hydrogen production. H.Vandenborre (Studiecentrum voor Kernenergie, Mol, Belgium).
Elektrotechniek (Netherlands), vol.61, no.3, p.166-71 (March 1983).
Economic competition among different hydrogen production processes is changing due to the increasing cost of fossil raw materials as naphta and natural gas. State-of-the-art and advanced R and D programmes for hydrogen production by water electrolysis are given. Cost analysis are related to the use of off-peak nuclear electricity for the electrolysis process. (17 refs.)

Isotopic effects in hydrogen-intermetallic compounds systems . See Entry 68505

The market potential of the high-temperature reactor ....See Entry 68858

86.70 ENVIRONMENTAL SCIENCE

(see also 87.60R Radioactive pollution; for oceanographic aspects, see 92.10; for hydrological aspects see 92.40; for meteorological aspects see 92.60)

86.70C Soil

68903 Particle-size distribution and phosphorus levels in soil, sediment, and urban dust and dirt samples from the Menomonee River watershed, Wisconsin, USA. A.Dong, G.V.Simsiman, G.Chesters (Dept. of Soil Sci., Univ. of Wisconsin, Madison, WI, USA).
Water Res. (GB), vol.17, no.5, p.569-77 (1983).
Soil, bottom sediment, and urban street dust and dirt samples from the Menomonee River Watershed, Wisconsin, were dispersed by ultrasound, fractionated and analyzed for the P content each of three particle-size fractions. The major soil types in the watershed were used as a reference for comparing particle-size distribution and P content in urban street dust and dirt, and in sediments. (17 refs.)

Second International Symposium on Integrated Global Monitoring of Environmental Pollution ....See Entry 64575

Biological intrusion of low-level waste trench covers ....See Entry 65414

86.70E Water

68904 Mercury and chlorinated hydrocarbons in sediments from the Bay of Naples and adjacent marine areas. F.Baldi, R.Bargagli, S.Focardi, C.Fossi (Univ. di Siena, Siena, Italy).
Mar. Pollut. Bull. (GB), vol.14, no.3, p.108-11 (March 1983).
The authors report the distribution of mercury, pesticides and PCBs in superficial sediments and a sediment core obtained in July 1980 from the Bay of Naples and adjacent marine areas from 40° 20′ to 41° 20′ N. (14 refs.)

68905 Mine-derived metal pollution in the Isle of Man. T.Southgate, D.J.Slinn, J.F.Eastham (Dept. of Marine Biology, Univ. of Liverpool, Port Erin, Isle of Man).
Mar. Pollut. Bull. (GB), vol.14, no.4, p.137-40 (April 1983).
The sediments of rivers draining areas of past mining activity in the Isle of Man contained greatly enhanced levels of zinc, lead and, to a lesser extent, copper and cadmium. This contamination extended into the estuarine harbours where it was reflected in the metal content of four species of bivalve molluscs. Of the latter, Mytilus edulis was the most useful indicator species in that it occurred in all five estuarine harbours but Scrobicularia plana, although of more limited distribution, concentrated much higher levels of zinc and lead. Individual variation of metal levels was high in all species of bivalves examined; a negative correlation of dry weight:metal content was demonstrated in many cases, but other factors may also contribute to such variation. (20 refs.)

68906 Accumulation of mercury in fish and man from reservoirs in northern Finland. M.Lodenius, A.Seppanen, M.Herranen (Dept. of Environmental Sci., Univ. of Helsinki, Helsinki, Finland).
Water, Air & Soil Pollut. (Netherlands), vol.19, no.3, p.237-46 (April 1983).
Samples of fish and human hair have been analyzed for Hg content. The concentrations of Hg in fish from man-made lakes were higher than in fish from a background (natural) lake. Fish of prey, burbot (Lota lota) and pike (Esox lucius) contained more Hg (max 2.0 mg kg^{-1}) than other species of fish and higher values were recorded in the flesh than in the liver. In the Porttipahta reservoir the Hg content of burbot and pike exceeded the Finnish safety limits of 0.5 and 1 mg kg^{-1}. In samples of human hair there was also a clear difference between persons living near man-made lakes (mean 4.9 mg kg^{-1}) and background (mean 1.6 mg kg^{-1}) areas. The highest concentrations (about 30 mg kg^{-1}) were found in hair samples from middle-aged people eating substantial amounts of fish from reservoirs. The concentrations were higher in males than in females probably caused by a higher fish consumption. (50 refs.)

68907 Modeling thermal plumes in tidal rivers. J.Hauser, D.Eppel, M.Lobmeyr, A.Nehlsen, A.Muller (Inst. fur Phys., GKSS-Res. Center, Geesthacht, Germany), F.Tanzer.
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.270-3, vol.2
The assessment of possible detrimental effects of pollutant discharges by power plants, industrial sites and municipalities on the aquatic life is a vital task. From the standpoint of environmental protection it is desirable to predict any effects on the ecosystem before a power plant or industrial site is constructed. Hence mathematical modeling plays an important role in simulating the behavior of environmental systems. The paper is concerned with pollutant propagation in tidal rivers, bays or estuaries. Emphasis is on reliability, accuracy and verification of simulation models. The mathematical formulation and the numerical solution of the resulting system of ordinary differential equations is only briefly outlined. Numerous examples are given to exemplify possible pitfalls and how to get around these difficulties. All examples are compared with measured field-data. Since the measurements carried out were mainly concerned with the determination of thermal plumes, the mathematical calculations simulate the spread of these plumes. However, the model along with the mathematical formulation is not restricted to thermal propagation but allows the computation of any pollutant concentration, provided the proper source and sink terms are specified. (20 refs.)

Second International Symposium on Integrated Global Monitoring of Environmental Pollution ....See Entry 64575

Scientific Basis for Nuclear Waste Management V. Proceedings of the Materials Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste ....See Entry 64593

The use of ^{222}Rn as a flow path monitor for studies of radionuclide transport in fissures .... See Entry 65374

Site characterisation for field radionuclide migration studies in Climax granite ....See Entry 65376

Nuclide migration field experiments in tuff, G tunnel, Nevada Test Site ....See Entry 65377

Predicting Pu concentrations in solutions contacting geologic materials ....See Entry 65378

Transient hydraulic tests in granite: fissured porous medium analysis and results .... See Entry 65379

Radionuclide migration: laboratory experiments with isolated fractures ....See Entry 65381

Radiogeological assessment of candidate sites for nuclear waste repositories, exemplified by studies of the Stripa Pluton, Sweden .... See Entry 65386

Diffusion measurements in compacted bentonite .... See Entry 65388

The dissolution of irradiated fuel under hydrothermal conditions ....See Entry 65391

Permeability, swelling and radionuclide retardation properties of candidate backfill materials .... See Entry 65392

Mechanisms of dissolution of radioactive waste storage glasses and caesium migration from a granite repository ....See Entry 65394

Experimental and theoretical analyses of small-scale radionuclide migration field experiments ....See Entry 65397

Reference laboratory testing for backfill ....See Entry 65398

Novel experiments for understanding the shallow land burial of low-level radioactive wastes ....See Entry 65404

Stochastic analysis of groundwater flow and contaminant transport in a fractured rock system .... See Entry 65406

Migration of radionuclide chains in subseabed disposal .... See Entry 65418

INTRACOIN — an international nuclide transport code intercomparison study .. ..See Entry 65465

Modelling nearshore oil slick trajectories ....See Entry 69254

Marine litter distribution and composition in the North Sea ...See Entry 69255

86.70G Atmosphere

68908 New application of dependence between mean times of sampling and maximal air pollutant concentrations. S.L.Doychinov (Sofia Univ., Sofia, Bulgaria).
C.R. Acad. Bulg. Sci. (Bulgaria), vol.35, no.12, p.1681-4 (1982).
The destructive action of air pollutants on monuments of architecture and arts is becoming ever more tangible in contemporary ecological conditions. Most exposed to it are frescos, which are particularly vulnerable to SO_2, oxidants, metal aerosols and dust. SO_2 catalytically oxidizes to SO_3 and after hydrolysis forms H_2SO_4, which destroys the pigment layer and the carbonate base of frescos. Oxidants, which are a mixture of active oxidizing agents, attack the pigment layer and the organic components of frescos, while metal aerosols catalyze different processes in the atmosphere and on the pictorial layer. For instance, Fe, Mn, Cu, Zn, Al, etc., oxidize SO_2 to SO_3. Dust is an excellent contact surface for catalytic processes in the atmosphere. Two of Bulgaria's most valuable monuments of culture, located in quite different surroundings, were chosen as models in the author's investigations: Boyana Church, proclaimed by UNESCO as a monument of world significance and lying 8 km south of Sofia, and St. Petka Samardjiyska Church, which is situated in the city centre. (10 refs.)

68909 Methane flux across the air-water interface: air velocity effects. D.I.Sebacher, R.C.Harriss, K.B.Bartlett (NASA Langley Res. Center, Hampton, VA, USA).
Tellus Ser. B (Sweden), vol.35B, no.2, p.103-9 (April 1983).
Methane flux from the air-water interface of freshwater-covered wetland ponds is shown to increase approximately as the square of the air velocity over the water surface. CH_4 fluxes were measured using a partitioned chamber placed over the water surface where the air velocity along the surface can be controlled. Correlating measurements of CH_4 fluxes and surface water dissolved CH_4 concentrations to air velocities provide a means to evaluate the liquid phase exchange coefficient for a two-layer model of the gas-liquid interface. The liquid phase exchange coefficient for CH_4 is calculated for air velocities of zero and for air velocities from 1.4 to 3.5 m s^{-1} and water temperatures of 20°C. (30 refs.)

68910 Atmospheric balance of sulphur above an equatorial forest. R.Delmas (Dept. de Phys., Faculte des Sci. d'Abidjan, Abidjan, Ivory Coast), J.Servant.
Tellus Ser. B (Sweden), vol.35B, no.2, p.110-20 (April 1983).
The atmospheric sulphur balance over the humid tropical forest of the Ivory Coast is studied over a 1-year period. A box model limited by the monsoon

layer between the coast of the Gulf of Guinea and the savannah is used. The sulphur compounds considered are gaseous H_2S and SO_2 and particulate $SO_4^{=}$. Chemical criteria are used to differentiate the $SO_4^{=}$ of atmospheric, oceanic, soil-derived and plant origins. The sulphur compounds are measured in the air and in the rain-water at 2 stations, one at the box entry (Adiopodoume) and the second at the exit (Lamto). (19 refs.)

68911 Seasonal variations of Cd, Pb, Cu and Ni levels in snow from the eastern Arctic Ocean. L.Mart (Chem. Dept., Inst. of Appl. Phys. Chem., KFA, Juelich, Germany).
Tellus Ser. B (Sweden), vol.35B, no.2, p.131-41 (April 1983).
During the Swedish Arctic expedition 'Ymer 80' into the area from North Greenland to Franz-Josef-Land in late summer 1980, freshly fallen snow, and snow from the previous fall/winter season were collected from ice floes. Lead, cadmium and copper analysis was performed on board ship, using the advanced voltammetric determination method of differential pulse anodic stripping voltammetry at rotating glassy carbon electrodes. The analytic operations were performed under a clean room container. Nickel, and tentatively, cobalt levels were analyzed in a laboratory by differential pulse voltammetry after preconcentration by chelate adsorption at a hanging mercury drop electrode. (37 refs.)

68912 Mathematical modeling of cooling tower plumes. R.Carhart (Dept. of Phys., Univ. of Illinois, Chicago, IL, USA), A.Policastro.
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.274-6, vol.2
The vast majority of mathematical models used to predict plume rise from natural-draft (NDCT) and mechanical-draft (MDCT) cooling towers employ the integral approach. The following significant areas of controversy which exist in the theoretical development of such models: assumptions needed to assure the proper balance between buoyancy and momentum transfer mechanisms; (b) treatment of thermodynamics; (c) treatment of tower downwash; (d) treatment of atmospheric diffusion, and (e) proper method for merging of plumes. The most successful models employ assumptions which appear physically reasonable with calibration of unknown coefficients with field and/or laboratory data. Such models are capable of predicting visible plume rise within a factor of 2 and visible plume length within a factor of 2.5 for 50-75% of most new field cases. Such accuracy is sufficient for most design and environmental impact evaluations. Only the ANL and KUMULUS Models of this better-performing group are sufficiently general, however, to handle any configuration of NDCTs and MDCTs. (4 refs.)

Second International Symposium on Integrated Global Monitoring of Environmental Pollution .... See Entry 64575

Regularizing the solution of the laser sounding equation of atmospheric aerosols by means of a stabilizing functional .... See Entry 66316

PIXE analysis of aerosol in the workplace .... See Entry 68823

Monitoring aerosol elemental composition in particle size fractions in case of long-range transport .... See Entry 68913

Use of sulphur hexafluoride in atmospheric diffusion tracing .. See Entry 68914

Chemical elemental composition of wind-blown dust, April 19, 1980, Beijing .... See Entry 69325

86.70L Measurement techniques in environmental science

68913 Monitoring aerosol elemental composition in particle size fractions in case of long-range transport. P.Metternich, H.-W.Georgii, K.O.Groeneveld (Johann Wolfgang Goethe-Univ., Frankfurt/Main, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1282-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Collection of atmospheric samples was performed at Malta, a semi-remote environment in the Mediterranean, in case of long-range transport studies of pollutants and natural substances. Using PIXE as a non-destructive trace-element analytical tool, the elemental composition of these samples was determined. Atmospheric concentrations obtained in this study were of one magnitude higher than those observed over the open North Atlantic in purely marine air. For most of the anomalously enriched elements in the Mediterranean aerosol, the high concentrations can be explained by long-range transport. (17 refs.)

68914 Use of sulphur hexafluoride in atmospheric diffusion tracing. Li Shikui (Central Meteorological Bur., Beijing, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1191-2 (Nov. 1982). [received: April 1983]
Mid-range atmospheric diffusion is one of the most important problems of pollution meteorology. In the last decade, the development and application of SF_6 tracing techniques have provided a new effective method for mid-range atmospheric diffusion studies. Its tracing range is from several kilometres to over a hundred kilometres. The author has made more than thirty field diffusion experiments using the SF_6 tracing technique to simulate diffusion of pollutants from elevated sources along a coastal area as well as in a mountain valley. (4 refs.)

A study of geometrical factor in optical particle counters .... See Entry 64940

PIXE analysis of aerosol in the workplace .... See Entry 68823

Investigation of remote sensing possibilities of the lower atmosphere in the microwave range and some aspects of statistical data use .... See Entry 69329

86.70Z Other topics

Diffusion of neptunyl(V)- and pertechnetate ions in marine sediments .... See Entry 65385

Predictions of radionuclide migration rates for a subseabed repository .... See Entry 65387

Modeling thermal plumes in tidal rivers .... See Entry 68907

86.90 OTHER TOPICS IN ENERGY RESEARCH AND ENVIRONMENTAL SCIENCE

Iron-enriched basalt for containment of nuclear wastes .... See Entry 65361

Influence of irradiation with gamma-quanta and beam of accelerated electrons on the sorption parameters of clay minerals of the montmorillonite group [radioactive waste] .... See Entry 65436

87.00 BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

87.10 GENERAL, THEORETICAL, AND MATHEMATICAL BIOPHYSICS

(inc. logic of biosystems, quantum biology, and relevant aspects of thermodynamics, information theory, cybernetics, and bionics)

An introduction to the application of system identification techniques to elements of the neuromuscular system .... See Entry 68952

Determination of forces in extensor pollicis longus and flexor pollicis longus of the thumb .... See Entry 68959

Mathematical model of the human ankle joint .... See Entry 68969

Two-dimensional dynamic modelling of human knee joint .... See Entry 68970

Comparison of computer models of the human arterial system for the assessment of clinical data .... See Entry 68973

Dynamic simulation of the renal medulla .... See Entry 68974

System identification of the blood pressure control system by low frequency neural stimulation .... See Entry 68976

87.15 MOLECULAR BIOPHYSICS

(see also 36.20 Macromolecules and polymer molecules)

68915 DNA and protein lattice-lattice interactions in the filamentous bacteriophages. C.J.Marzec, L.A.Day (Public Health Res. Inst., New York, NY, USA).
Biophys. J. (USA), vol.42, no.2, p.171-80 (May 1983).
The relations between the protein coats and DNAs of the four filamentous bacteriophages fd, Xf, Pfl, and Pf3 are considered. These viruses have similar morphologies, yet show a diversity of detailed structure, having different protein coat symmetries (helical and rotational), different coat protein sizes (44-50 amino acids per subunit) and sequences, different nucleotide axial translations (2.3-5.5 Å), and different ratios of nucleotides per coat protein subunit (integers 1.0 and 2.0, and nonintegers ~2.4). These divergences are all reconciled quantitatively by means of two theoretical concepts: the pitch connection and the restricted pitch connection. The pitch connection relates protein and DNA surface lattices with arbitrary, nonintegral nucleotide/subunit ratios in a nonrandom way. The retricted pitch connection selects a preferred set of n/s values. Both relations are derived formally in a mathematical appendix. The available structural data are explained, including the fd DNA pitch indicated by X-ray diffraction photos and the similar DNA morphologies of Xf and fd. Predictions are made for the existence of nonclassical inverted DNA structures (I-DNA) in Pf1 and Pf3. (26 refs.)

68916 An enzyme reaction with a strange attractor. L.F.Olsen (Inst. of Biochem., Odense Univ., Odense M, Denmark).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.454-7 (4 April 1983).
A simple model of the oscillating peroxidase-oxidase reaction is presented. The model is capable of reproducing all previously observed dynamic patterns exhibited by the experimental system including its chaotic behaviour. (14 refs.)

Sensitivity of V_2' saturation transfer electron paramagnetic resonance signals to anisotropic rotational diffusion with [^{15}N] nitroxide spin-labels. Effects of noncoincident magnetic and diffusion tensor principal axes .... See Entry 64925

Raman and IR studies of the antileprotic drug Dapsone .... See Entry 65999

Mechanism of T_1 relaxation in ^{13}CO complexed to an iron porphyrin: implications for CO bonding in heme proteins .... See Entry 66015

The influence of protein dynamics on Mossbauer spectra .... See Entry 66167

Static and dynamic light scattering studies of micellar growth and interactions in bile salt solutions .... See Entry 68808

87.15B Structure, configuration, conformation, and active sites at the biomolecular level

68917 Organization of calcium pump protein dimers in the isolated sarcoplasmic reticulum membrane. C.A.Napolitano, P.Cooke (Univ. of Connecticut, Farmington, CT, USA), K.Segalman, L.Herbette.
Biophys. J. (USA), vol.42, no.2, p.119-25 (May 1983).
The arrangement of the calcium pump protein in the isolated sarcoplasmic reticulum (SR) membrane was examined by optical diffraction of freeze-fracture electron micrographs. Several states of protein particle organization were observed: random, hexagonal and tetragonal packing, and a mixture of hexagonal and tetragonal packing. This suggests that the time-averaged positions of protein particles in the plane of the SSR membrane are weakly defined. In addition, there appears to be a greater degree of local or short-range order compared to long-range order within the field of freeze-fracture particles. The authors utilized mesurements from tetragonally or hexagonally packed arrays to determine a unit cell area occupied by each freeze-fracture particle and its associated lipid matrix. When these unit cell areas and the stereologically determined area per freeze-fracture particle were compared to the cross-sectional area occupied by a single calcium pump protein and its associated lipid, obtained by X-ray and neutron diffraction methods, the authors concluded that each freeze-fracture particle probably represents a dimer of pump protein molecules in the plane of the SR membrane. (38 refs.)

68918 Thermodynamic properties of the lipid bilayer transition. Pseudocritical phenomena. S.Mitaku, T.Jippo, R.Kataoka (Dept. of Material Systems Engng., Tokyo Univ. of Agriculture & Technol., Tokyo, Japan).
Biophys. J. (USA), vol.42, no.2, p.137-44 (May 1983).
Ultrasonic relaxation of multilamellar liposomes formed from dipalmitoylphosphatidylcholine was measured near the gel-to-liquid crystal transition by a differential ultrasonic resonator. The relaxation times and strength increased remarkably near the transition temperature, indicating a pseudocritical phenomenon. A quantitative analysis of the relaxation in terms of thermodynamic relationships between specific heat, thermal-expansion coefficient, and compressibility showed that more than 90% of the total endothermic heat of the transition arises from the latent heat. The temperature dependence of the ultrasonic relaxation parameters was also analyzed by the Landau theory; the authors obtained a small but finite difference, 0.6°C, between the pseudocritical temperature and the transition temperature. These results provide a quantitative description of both the first-order and second-order characters of the gel-to-liquid crystal transition. (42 refs.)

68919 The molecular symmetry of glutaminase-asparaginases: rotation function studies of the Pseudomonas 7A and acinetobacter enzymes. H.L.Ammon, K.C.Murphy (Dept. of Chem., Univ. of Maryland, College Park, MD, USA), L.Sjolin, A.Wlodawer, J.S.Holcenberg, J.Roberts.
Acta Crystallogr. Sect. B (Denmark), vol.B39, pt.2, p.250-7 (1 April 1983).
The molecular symmetry of crystalline Pseudomonas 7A glutaminase-asparaginase (orthorhombic, $P2_12_12_1$, a=118.0, b=131.2, c=85.1 Å), which contains one 139000 g mol^{-1} tetramer per asymmetric unit, has been studied with Patterson rotation techniques. The results are completely consistent with 222 point-group symmetry. The relative orientations of the crystalline Acinetobacter glutaminase-asparaginase (orthorhombic, $I222$, a=96.7, b=112.4, c=70.9 Å), which contains one subunit per asymmetric unit, and the Pseudomonas 7A enzyme have been established with the so-called locked and cross-rotation functions. The presence of 222 symmetry in these tetramers is consistent with several previous investigations of the asparaginases. (36 refs.)

68920 Perturbation of the hydrogen-bond equilibrium in nucleic bases. An infrared study. R.Buchet, C.Sandorfy (Dept. de Chimie, Univ. de Montreal, Montreal, Quebec, Canada).
J. Phys. Chem. (USA), vol.87, no.2, p.275-80 (20 Jan. 1983).
The ways in which the hydrogen-bond equilibrium can be perturbed in the 1-cyclohexyluracil (CU) dimer and in the 1-cyclohexyluracil/9-ethyladenine (EA) complex have been examined by infrared and proton NMR spectroscopy. The perturbers used were high concentrations of halofluorocarbon anesthetics containing an acidic hydrogen like chloroform, halothane, methoxyflurane, and enflurane and barbiturates like phenobarbital (PB). It is shown that these perturbers are capable of opening a large proportion of the hydrogen bonds present in these base pairs. The effect of phenobarbital is particularly spectacular. The possible biological importance of these observations is stressed. (24 refs.)

68921 Molecular orbital study of the protonation of DNA bases. J.E.Del Bene (Dept. of Chem., Youngstown State Univ., Youngstown, OH, USA).
J. Phys. Chem. (USA), vol.87, no.2, p.367-71 (20 Jan. 1983).
Ab initio SCF calculations with the STO-3G basis set were performed to determine the optimized structures of the neutral and protonated DNA bases, thymine, cytosine, adenine, and guanine. Single-point Hartree-Fock calculations at these geometries were then carried out with the split-valence 4-31 G basis set to obtain the protonation energies. Protonation led to significant geometrical changes in the base, particularly in bond lengths and angles near the protonation site. Charge transfer to the proton occurred and was accompanied by polarization of electron density of the base toward the protonation site. (26 refs.)

68922 Structure of the influenza virus glycoprotein antigen neuraminidase at 2.9 Å resolution. J.N.Varghese (Div. of Protein Chem., CSIRO, Parkville, Victoria, Australia), W.G.Laver, P.M.Colman.
Nature (GB), vol.303, no.5912, p.35-40 (5 May 1983).
The influenza virus neuraminidase glycoprotein is a tetramer with a box-shaped head, 100×100×60 Å, attached to a slender stalk. The three-dimensional structure of neuraminidase heads shows that each monomer is composed of six topologically identical β-sheets arranged in a propeller formation. The tetrameric enzyme has circular 4-fold symmetry stabilized in part by metal ions bound on the symmetry axis. Sugar residues are attached to four of the five potential glycosylation sequences, and in one case contribute to the interaction between subunits in the tetramer. (52 refs.)

68923 Structure of the catalytic and antigenic sites in influenza virus neuraminidase. P.M.Colman, J.N.Varghese (Div. of Protein Chem., CSIRO, Parkville, Victoria, Australia), W.G.Laver.
Nature (GB), vol.303, no.5912, p.41-4 (5 May 1983).
The catalytic sites of influenza virus neuraminidase are located on the upper corners of the box-shaped tetramer that forms the head of the molecule. Antigenic determinants form a nearly-continuous surface across the top of the monomer encircling the catalytic site. Approximately the same number of amino acid sequence changes occurred in these determinants between the years 1968 and 1975 as occurred in the antigenic sites of influenza virus haemagglutinin in the same period. (25 refs.)

68924 Structure of trimeric haemerythrin. J.L.Smith, W.A.Hendrickson (Naval Res. Lab., Washington, DC, USA), A.W.Addison.
Nature (GB), vol.303, no.5912, p.86-8 (5 May 1983).
X-ray crystallography has been used to study the subunit structure of trimeric haemerythrin from a Siphonosoma species. It is reported that the pattern of intersubunit helix-helix interactions differs from the most common mode of association of other helix-bundle proteins. In a novel approach to structure analysis at low resolution, experimental phases for the structure determination were based on anomalous scattering from the iron atoms native to haemerythrin, using the new resolved-anomalous phasing procedure. (29 refs.)

Bond orbital framework for rapid calculation of environmental effects on molecular potential surfaces .... See Entry 65906

Possibility of the investigation of conformational changes in protein molecules with fluorescent probes in the picosecond time range .... See Entry 66062

Linear dichroism studies of flavins in stretched poly(vinyl alcohol) films. Molecular orientation and electronic transition moment directions .. See Entry 66069

Molecular electrostatic potential versus field. Significance for DNA and its constituents. .... See Entry 66165

Anisotropic rotational diffusion of an α helix and analysis of the internal motion of side chains .... See Entry 66166

The influence of protein dynamics on Mossbauer spectra .... See Entry 66167

87.15M Interactions with radiations at the biomolecular level

68925 Heavy ion induced desorption of biomolecules: dependence on the heavy ion parameters. H.Voit, H.Frohlich, P.Duck, B.Nees, E.Nieschler, W.Bischof, W.Tiereth (Phys. Inst., Univ. Erlangen-Nurnberg, Erlangen, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1759-61 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
High energy heavy ions (MeV/amu) from an accelerator or a fission source are able to desorb atoms and ions from dielectric solids (alkali halides, condensed gases, organic compounds) with desorption yields comparable to low energy sputtering yields. This high energy desorption has important applications in the mass spectroscopy of thermally labile biomolecules since large molecules can be desorbed as a whole with large probability. The authors study the dependence of the desorption yield for the amino acid valine on parameters of the primary ions like energy, mass and charge state q. They use different heavy ions from an EN tandem accelerator and a time-of-flight mass spectrometer in order to analyse the desorbed molecular ions. (4 refs.)

68926 Infrared study of trapped carbon dioxide in thermally treated apatites. S.E.P.Dowker, J.C.Elliott (Dept. of Biochem., London Hospital Medical Coll., London, England).
J. Solid State Chem. (USA), vol.47, no.2, p.164-73 (April 1983).
The formation of molecular CO_2 in synthetic apatities (prepared in aqueous systems), dental enabel, dentine, and various apatitic rock phosphates after heating in the range 120-900°C has been investigated by infrared spectroscopy. The CO_2 band at 2340 cm^{-1} was observed in the synthetic samples, enamel, and some of the rock phosphates, but not in dentine or bone. It is suggested that the absence of this band in dentine and bone is caused by the small crystal size of their apatites. The CO_2 band at 667 cm^{-1} was never observed. The polarized infrared spectrum of heated dental enamel showed that the linear CO_2 molecules were either randomly oriented or oriented so that the length of the molecules made an angle of about 56° with the c axis. It is suggested that, if the latter is correct, the CO_2 originates from a CO_3^{2-} ion which occupied the sloping face of the phosphate ion site. (40 refs.)

68927 Fourier transform infrared difference spectra of intermediates in rhodopsin bleaching. K.J.Rothschild, W.A.Cantore, H.Marrero (Dept. of Phys. & Physiology, Boston Univ., Boston, MA, USA).
Science (USA), vol.219, no.4590, p.1333-5 (18 March 1983).
The membrane protein rhodopsin is the primary light receptor in vision. Fourier transform infrared difference spectroscopy is sensitive to conformational changes in both the protein and the retinylidene chromosphore of rhodopsin. By blocking rhodopsin bleaching at specific intermediates, it is possible to elucidate some of the primary molecular events of vision. (25 refs.)

On the time variable in the description of molecular systems: from molecular transients to biomolecules .... See Entry 65943

Cadmium-113 NMR spin-lattice relaxation and exchange kinetics in Concanavalin A: A double saturation transfer experiment .... See Entry 66020

Multiplet selection using multiple quantum coherence .... See Entry 66026

A compact synchroscan streak camera using a microchannel plate incorporated tube .... See Entry 66046

Anisotropic rotational diffusion of an α helix and analysis of the internal motion of side chains .... See Entry 66166

The influence of protein dynamics on Mossbauer spectra .... See Entry 66167

87.16 BIOTHERMICS

68928 Role of surface area-to-mass ratio and work efficiency in heat intolerance. Y.Epstein, Y.Shapiro, S.Brill (Heller Inst. of Medical Res., Chaim Sheba Medical Center, Tel-Hashomer, Israel).
J. Appl. Physiol. (USA), vol.54, no.3, p.831-6 (March 1983).
Fourteen postheatstroke (*HS*) subjects and nine normal control subjects (*C*) with similar ($\dot{V}_{O2\ max}$) underwent a 180-min heat-tolerance test (ambient temperature 40°C, relative humidity 40%; 12 $steps.min^{-1}$ on a 30-cm high bench). In group *HS* nine subjects (*NHS*) thermoregulated similar to group *C*, while five subjects were identified as heat intolerant (*HI*), characterized by significantly higher heart rate (HR), rectal temperature (T_{re}), and heat storage (ΔS) than groups *NHS* and *C*. The work efficiency (η) was significantly lower in groups *HI* and *NHS* when compared with *C*. Skin surface area-to-body mass ratio (A_D/W) in group *HI* was significantly lower than in group *NHS* or *C*. Multiple regression analysis between each one of the dependent variables, HR, T_{re}, and ΔS, mean weighted skin temperature, and sweat rate, against the two independent variables, η and A_D/W, yielded significant correlations. The results suggest that a reduced η and/or a reduced A_D/W play a role in heat intolerance, causing increased heat production and a concomitantly less effective heat dissipation. (23 refs.)

68929 Calorimetry and psiumetry. A.I.Zotin (Inst. of Dev. Biology, Acad. of Sci., Moscow, USSR), I.H.D.Lamprecht.
J. Non-Equilibrium Thermodyn. (Germany), vol.7, no.6, p.323-38 (1982).
In many biologic processes such as development, growth and aging, differences occur when energy turnover is measured by direct or by indirect calorimetry. The theory is presented showing that part of the dissipative energy (psiu-function) is stored inside the organism and is not dissipated to the environment. According to the theory of minimum entropy production in a steady state, the psiu-function vanishes when the organism is approaching a steady state of metabolism. Examples are given for the slope of the psiu-function in oogenesis, embryonic development, growth of animals and microbial cultures and for the dependence of the psiu-function on body weight. (41 refs.)

Thermodynamic properties of the lipid bilayer transition. Pseudocritical phenomena .... See Entry 68918

Infrared study of trapped carbon dioxide in thermally treated apatites .... See Entry 68926

In vivo phosphorus-31 nuclear magnetic resonance reveals lowered ATP during heat shock of Tetrahymena .... See Entry 68935

Design of a cryogenic surgical instrument .... See Entry 69047

87.20 MEMBRANE BIOPHYSICS

68930 Effect of concentric multilamellae on the depolarized light scattering from phospholipid vesicles. K.Mishima (Dept. of Phys., Sophia Univ., Tokyo, Japan).
Chem. Phys. Lett. (Netherlands), vol.96, no.5, p.552-4 (22 April 1983).
An expression of the depolarization ratio is presented for multilayered spherical shells using the Rayleigh-Gans theory of light scattering. The effect of multilamellar bilayers of a phospholipid vesicle on the depolarization is investigated numerically. The depolarization ratio decreases markedly with increasing number of bilayers. (8 refs.)

68931 Photoelectrochemical observations on chlorophyll-carotene interactions in a lipid bilayer film. T.Miyasaka, K.Honda (Dept. of Synthetic Chem., Faculty of Engng., Univ. of Tokyo, Tokyo, Japan).
Thin Solid Films (Switzerland), vol.102, no.2, p.173-85 (15 April 1983).
Photoelectrochemical investigations were undertaken on energy transfer and other interactions between chlorophyll-a (Chl-a) and β-carotene (Car) in lipid monolayers. A heterobilayer composed of a Chl-a-lecithin monolayer and a Car-lecithin monolayer was prepared on an SnO_2 semiconductor electrode by Langmuir-Blodgett techniques. When the bilayer-coated electrode was irradiated in an aqueous electrolyte, anodic photocurrents due to the sensitizations by Chl-a and Car respectively were observed. The photocurrent efficiency (ratio of photons to electrons) was much lower for Car (about 10^{-3}) than for Chl-a (about 10^{-1}). This large difference permits a quantitative estimation of the energy transfer from Car to Chl-a, based on the concept that the energy transfer results in an increase in the Car-induced sensitized photocurrent. The effect of added Chl-a on the Car photocurrent was measured for heterobilay-

ers with various Chl-a-to-Car molar ratios. The experimental results, as well as theoretical calculations, showed that the Car-to-Chl-a energy transfer is inefficient. The effect of Car on the Chl-a-sensitized photocurrent was also studied with the same bilayer system. The effect was shown to be complex depending on the Car content. A lowering of the Chl-a photocurrent occurred at high Car contents, which is considered to reflect the quenching of the Chl-a excited triplet by Car. The usefulness of the present photoelectrochemical approach for the study of energy transfer between the photosynthetic pigments is demonstrated. (29 refs.)

Effect of the diffusion boundary layers on the surface charge density in passive membranes .... See Entry 68800

Organization of calcium pump protein dimers in the isolated sarcoplasmic reticulum membrane .... See Entry 68917

Thermodynamic properties of the lipid bilayer transition. Pseudocritical phenomena .... See Entry 68918

Minimal model for membrane oscillations in the pancreatic β-cell .... See Entry 68936

Voltage and Ca^{2+}-activated K^+ channel in baso-lateral acinar cell membranes of mammalian salivary glands .... See Entry 68939

Relationship between membrane excitability and single channel open-close kinetics .... See Entry 68941

87.25 CELLULAR BIOPHYSICS

68932 Theory of the electrokinetic behavior of human erythrocytes. S.Levine, M.Levine, K.A.Sharp, D.E.Brooks (Dept. of Pathology, Univ. of British Columbia, Vancouver, BC, Canada).
Biophys. J. (USA), vol.42, no.2, p.127-35 (May 1983).
Presents a theory of electrophoresis of human erythrocytes that predicts mobilities significantly smaller than those based on the classical Smoluchowski relation. In the classical treatment the charge is assumed to be spread uniformly on the hydrodynamic surface. The present model takes into acount that most of the charge, due mainly to sialic acid, is contained in the glycocalyx. The glycocalyx is modeled as a permeable layer of polyelectrolyte molecules anchored to the cell membrane. The charge is assumed to be uniformly distributed throughout this layer. The fluid flow in the layer is treated as being dominated by Stokes friction arising from idealized polymer segments. The Navier-Stokes equations are solved to give the dependence of electroosmotic velocity with distance from the cell surface. An expression for the electrophoretic mobility is obtained which contains two parameters (*a*) the thickness of the glycocalyx and (*b*) the mean polymer segment radius. The best fit to experimental data is obtained if these are given the values 75 Å and 7 Å, respectively. Deviation from experimental data at low ionic strength (<0.05 M) occurs. However, this deviation is in the direction one would expect if at low ionic strength the polyelectrolyte layer expands slightly due to decreased charge shielding. (32 refs.)

68933 The dynamics of the stress stage of osmotic haemolysis. H.A.Massaldi (CIDCA—Facultad de Ciencias Exactas, La Plata, Argentina), A.Fuchs, C.H.Borzi.
J. Biomech. (GB), vol.16, no.2, p.103-7 (1983).
A simple physical model for the dynamics of the stress stage of osmotic haemolysis is presented. An elastic restitutive coefficient for the red cell membrane is defined to relate the increase of internal pressure to the volume change during the stress stage, and it is estimated on the basis of the work of Evans et al. (1976, 1977). It is shown that the time elapsed between complete swelling and the start of haemoglobin leakage can be a substantial part of the total haemolysis time, in accordance with experimental results reported in the literature. (24 refs.)

68934 NMR studies of perfused cells. D.L.Foxall, J.S.Cohen (Dev. Pharmacology Branch, Nat. Inst. of Child Health & Human Dev., Nat. Inst. of Health, Bethesda, MD, USA).
J. Magn. Resonance (USA), vol.52, no.2, p.346-9 (April 1983).
NMR has been applied as a noninvasive method for the study of the metabolism of cells. To study cell suspensions by NMR they must be densely packed so that spectra with an adequate signal to noise ratio are obtained. This requirement makes NMR studies of cells difficult because they must be supplied with nutrients and oxygen to avoid cell death. Recently, two methods of perfusing cells have been described, both of which require that the cells adhere to a surface during culture, and this limits their applicaiton. The authors present a cell perfusion technique which relies upon embedding cells in an agarose matrix. (9 refs.)

68935 In vivo phosphorus-31 nuclear magnetic resonance reveals lowered ATP during heat shock of Tetrahymena. R.C.Findly, R.J.Gillies, R.G.Shulman (Dept. of Biology, Yale Univ., New Haven, CT, USA).
Science (USA), vol.219, no.4589, p.1223-5 (11 March 1983).
Cells synthesize a characteristic set of proteins—heat shock proteins—in response to a rapid temperature jump or certain other stress treatments. The technique of phosphorus-31 nuclear magnetic resonance spectroscopy was used to examine in vivo the effects of temperature jump on two species of Tetrahymena that initiate the heat shock response at different temperatures. An immediate 50 percent decrease in cellular adenosine triphosphate was observed when either species was jumped to a temperature that strongly induces synthesis of heat shock proteins. This new adenosine triphosphate concentration was maintained at the heat shock temperature. (12 refs.)

Heterogeneous bubble nucleation and conditions for growth in a liquid-gas system of constant mass and volume [bone cell application] .... See Entry 67177

Effect of concentric multilamellae on the depolarized light scattering from phospholipid vesicles .... See Entry 68930

Photoelectrochemical observations on chlorophyll-carotene interactions in a lipid bilayer film .... See Entry 68931

Changes in cell shape and actin distribution induced by constant electric fields .... See Entry 68979

Growth kinetics of Bp8 mouse ascites sarcoma after single doses of whole body irradiation. II. Analysis of the progression of cells through the cell cycle .... See Entry 68981

Estimation of a single property of low LET radiations which correlates with biological effectiveness .... See Entry 68984

The effect of radiation on bioluminescent bacteria: possible use of luminescent bacteria as a biological dosemeter .... See Entry 68985

Interaction of natural radioprotectants and gamma radiation in rabbit erythrocytes .... See Entry 68987

Mammalian spermatogenesis as a new system for biologic dosimetry of ionizing irradiation .... See Entry 69025

Blood platelet aggregometer: predicted effects of aggregation, photometer geometry, and multiple scattering .... See Entry 69060

A device for the electrical measurement of the deformability of red blood cells .... See Entry 69061

Ferritin as a label for high-gradient magnetic separation .... See Entry 69065

Fluorescence monitoring of electrical responses from small neurons and their processes .... See Entry 69067

Trace element distribution at the subcellular level—possible correlation between zinc and mRNA .... See Entry 69075

A system for dynamic analysis in biological systems with carbon-11 .... See Entry 69077

Improved filtration method for red cell deformability measurement .... See Entry 69082

87.25D Biological transport; cellular and subcellular transmembrane physics

68936 Minimal model for membrane oscillations in the pancreatic β-cell. T.R.Chay (Dept. of Biological Sci., Univ. of Pittsburgh, Pittsburgh, PA, USA), J.Keizer.
Biophys. J. (USA), vol.42, no.2, p.181-9 (May 1983).
Following the experimental findings of water et al. (in Biochemistry Biophysics of the Pancreatic-β-Cell, George Thieme Verlag, New York, p.100, 1980), the authors have formulated a mathematical model for ionic and electrical events that take place in pancreatic β-cells. Their formulation incorporates a Hodgkin-Huyxley type gating mechanism for Ca^{2+} and K^+ channels, in addition to Ca^{2+} gated K^+-channels. Consistent with the experimental observations, the authors' model generates spikes and bursts in β-cell membrane potentials and gives the correct responses to additions of glucose, quinine, and tetraethylammonium ions. The response of the oscillations to ouabain and changing concentrations of external K^+ can be incorporated into the present model, although a more complete treatment would require inclusion of the Na^+/K^+ pump. (25 refs.)

68937 A note on the reactivation of the fast sodium current in spherical clusters of embryonic chick heart cells. L.Ebihara, N.Shigeto, M.Lieberman, E.A.Johnson (Dept. of Physiology, Duke Univ. Medical Center, Durham, NC, USA).
Biophys. J. (USA), vol.42, no.2, p.191-3 (May 1983).
Reactivation of the fast sodium current in spherical clusters of embryonic chick heart cells was studied using the two-microelectrode voltage-clamp technique. The results show that there are at least two phases of reactivation. The contribution of the two phases to the overall reactivation process is highly dependent on the particular pulse protocol used to measure them. (15 refs.)

68938 Movement of interstitial water through loaded articular cartilage. P.A.Torzilli, D.A.Dethmers, D.E.Rose (Dept. of Biomech., Hospital for Special Surgery, Cornell Univ. Medical Coll., New York, NY, USA), H.F.Schryuer.
J. Biomech. (GB), vol.16, no.3, p.169-79 (1983).
Water transport through articular cartilage and across the articular surface is a major factor controlling the amount and rate of tissue deformation. To study water movement concentration profiles within the tissue were determined using radiotracer techniques. Water movement was spatially and temporally mapped for unloaded, undeformed tissue, after cyclic and dead weight creep, and for recovery following dead weight creep using a uniaxial confined compression configuration to produce one-dimensional fluid movement. In unloaded tissue diffusion rapidly exchanged water by 15 minutes while the gross efflux of fluid during cyclic and dead weight creep compression effectively inhibited any external water influx. During recovery fluid imbibition was restricted when a small surface load was present, and only after complete removal of all surface traction was a large fluid efflux found. The compression and/or collapse of the uppermost surface layer of the tissue is believed responsible for controlling tissue fluid transport and mechanical response. (28 refs.)

68939 Voltage and Ca^{2+}-activated K^+ channel in baso-lateral acinar cell membranes of mammalian salivary glands. Y.Maruyama, D.V.Gallacher, O.H.Petersen (Physiological Lab., Univ. of Liverpool, Liverpool, England).
Nature (GB), vol.302, no.5911, p.827-9 (28 April 1983).
Demonstrates directly, by using the patch-clamp technique, the existence of a K^+ channel with a large conductance localized in the basolateral plasma membranes of mouse and rat salivary gland acinar cells. The K^+ channel has a conductance of ~ 250 pS in the presence of high K^+ solutions on both sides of the membrane. Although mammalian exocrine glands are believed not to possess voltage-activated channels, the probability of opening the salivary gland K^+ channel opening, particularly at higher membrane potentials, was increased markedly by elevating the internal ionized Ca^{2+} concentration, as previously shown for high-conductance K^+ channels from cells of neutral origin. The Ca^{2+} and voltage-activated K^+ channel explains the marked cellular K^+ release that is characteristically observed when salivary glands are stimulated to secrete. (22 refs.)

68940 Movement of myosin-coated fluorescent beads on actin cables in vitro. M.P.Sheetz (Dept. of Physiology, Univ. of Connecticut Health Center, Farmington, CT, USA), J.A.Spudich.
Nature (GB), vol.303, no.5912, p.31-5 (5 May 1983).
Myosin-coated fluorescent beads are observed to move unidirectionally along organized actin filament arrays in the alga, Nitella, with an average velocity similar to in vivo rates of movement in muscle and other cells. The myosin produces the motive force, as the movement is ATP dependent and is blocked by inactivation of the myosin heads. The movement, which occurs in the absence of bipolar thick filaments, provides a quantitative assay for myosin motility. (31 refs.)

A theoretical study on the sucrose gap technique as applied to multicellular muscle preparations. III. Methodical errors in the determination of inward currents .... See Entry 69066

87.30 BIOPHYSICS OF NEUROPHYSIOLOGICAL PROCESSES

(exc. perception processes and speech)

68941 Relationship between membrane excitability and single channel open-close kinetics. J.R.Clay, L.J.DeFelice (Nat. Inst. of Neurological, Communicative Disorders & Stroke, Nat. Insts. of Health, Woods Hole, MA, USA).
Biophys. J. (USA), vol.42, no.2, p.151-7 (May 1983).
Describes a novel technique for simulating the influence of the effects of single channel kinetics on the voltage changes associated with membrane exci-

tability. The technique uses probability distribution functions for the durations of channel open- and closed-state lifetimes, which can be calculated for any model of the ion conductance process. To illustrate the technique, the authors have used the Hodgkin and Huxley model of nerve membrane ion conductance to simulate channel kinetics during predetermined voltage changes, such as a voltage jump and an action potential. The authors have also simulated the influence of channels on voltage changes in a free running, non-voltage-clamped patch of membrane 1 μm^2 or less in area. The latter results provide a direct illustration of the relationship between fluctuations of membrane excitability and fluctuations in channel open- and closed-state lifetimes. (36 refs.)

68942 Dielectric breakdown of human skin in vivo. S.Grimnes (Dept. of Biomedical Engng., Rikshospitalet, Oslo, Norway).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.379-81 (May 1983).
The human skin is normally a high-impedance tissue. In an electric shock (e.g. unintended power line shock or intended defibrillator shock) this high impedance is broken down. The isolating part of the skin is the stratum corneum which is often only 10 μm thick, and it is therefore easy to presuppose a dielectric breakdown mechanism. However, the skin admittance is of an electrolytic nature (Rosendal, 1945), and the question is whether it is relevant to consider a dielectric breakdown mechanism at all. This technical note tries to estimate the importance of a dielectric breakdown mechanism in human skin in vivo. It is based upon a method which sufficiently reduces the influence of the electrolytic admittance. Because dielectric breakdown in the experiments described was slow and not pronounced up to 300-500 V, it is not probable that breakdown with power line potentials is of dielectric origin. It is difficult from the results reported to decide the breakdown mechanism during defibrillator shock. A dielectric breakdown mechanism from >2 kΩ to <25 Ω must be considered. (9 refs.)

Theory of the electrokinetic behavior of human erythrocytes ...See Entry 68932

Minimal model for membrane oscillations in the pancreatic β-cell ....See Entry 68936

A note on the reactivation of the fast sodium current in spherical clusters of embryonic chick heart cells .... See Entry 68937

Voltage and Ca^{2+}-activated K^+ channel in baso-lateral acinar cell membranes of mammalian salivary glands .... See Entry 68939

Determination of forces in extensor pollicis longus and flexor pollicis longus of the thumb ....See Entry 68959

Total airway resistance and respiratory muscle activity during sleep ....See Entry 68961

Brain function monitoring: a new method for simultaneous recording and processing of EEG-power spectra and brainstem potentials (BAEP) ....See Entry 69032

A PDP-11 assembly language program for digitizing, sorting, and averaging evoked brain potentials ....See Entry 69033

Digital filtering and regression algorithms for an accurate detection of the baseline in ECG signals ....See Entry 69038

Monitoring bruxism ....See Entry 69041

Turning points spectral analysis of the interference myoelectric activity ....See Entry 69043

Electrical stimulation of the spinal cord: a further analysis relating to anatomical factors and tissue properties .... See Entry 69053

Equipment using an impedance technique for automatic recording of fluid-volume changes during haemodialysis ....See Entry 69054

A microprocessor control system and solid state interface for controlling electrophysiological studies of conditioning .... See Entry 69064

A theoretical study on the sucrose gap technique as applied to multicellular muscle preparations. III. Methodical errors in the determination of inward currents ....See Entry 69066

Fluorescence monitoring of electrical responses from small neurons and their processes .... See Entry 69067

Improved Ag/AgCl pressure electrodes .... See Entry 69085

Modeling of the Sino-Atrial node .... See Entry 69088

87.32 PHYSIOLOGICAL OPTICS, VISION

68943 The Berkeley orthokeratology study. III. Safety. K.A.Polse, R.J.Brand, R.J.Keener, J.S.Schwalbe (School of Optometry, Univ. of California, Berkeley, CA, USA), D.W.Vastine.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.321-8 (April 1983).
For pt.II see ibid., vol.60, p.187-98 (1983). The safety of orthokeratological (OK) procedures was assessed by monitoring several ocular characteristics including corneal thickness, refractive astigmatism, corneal astigmatism, correctable spectacle acuity, corneal edema, corneal staining, and endothelial cell density. Safety was also assessed by reviewing the number and causes of extra clinical visits that occurred because of ocular complications and by determining whether safety factors were related to patients lost to follow-up. It appears that OK treatment is safe for the types of patients who participated in this study, but it may require more patient monitoring than would be needed to achieve and maintain a physiologically acceptable fit with conventional hard contact lens prescriptions. (16 refs.)

Standards for use of visible and nonvisible radiation on the eye ....See Entry 68980

Evaluation system for absolute brightness from the retinal vessels ....See Entry 68994

Selectively absorbing glasses for the potential prevention of ocular disorders ....See Entry 69030

87.32C Anatomy and optics of the eye

68944 Retinal images and astigmatic distortions in the individual corrected aphakic eye. L.B.Godio (Coll. of Optometry, Univ. of Houston, Houston, TX, USA), M.P.Keating.
Appl. Opt. (USA), vol.22, no.8, p.1221-6 (15 April 1983).
For paraxial objects viewed at finite distances from the correction plane, retinal image size and retinal distortions due to astigmatism are obtained for spectacle- or contact-lens-corrected aphakic individuals with astigmatism. The authors' methods are based not on the analysis of schematic or reduced eyes but on clinical measurements (corneal, refractive, pachometer, and correction parameters) that correspond to the individual patient. (12 refs.)

68945 Optical prophylaxis for environmental myopia: an epidemiological assessment of short-term effects. J.Daubs (TWR Corp., Ft. Lauderdale, FL, USA), A.J.Shotwell.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.316-20 (April 1983).
From a cohort study of 120 young (18 to 20 years of age) male military students with low initial refractive error ($\leq \pm 1$ D, spherical equivalent), estimates were made of the short-term (5 months) effect of two forms of optical treatment to prevent school-related myopia. The cumulative incidence of clinically significant (>0.25 D, spherical equivalent) myopic progression was less [standardized morbidity ratio (SMR)$=0.45$] among those prescribed monofocal convex lenses ($+1.25$ D over far R) and prisms (2 Δ base-in OU) and even more reduced (SMR$=0.32$) among those prescribed bifocals ($+1.5$ D near adds) compared with those receiving sham treatment (no. 1 pink tint). Placebo-treated patients were more than twice [rate ratio (RR)$=2.2$, 1.5] as likely as the monofocal group, and more than three times (RR$=3.2$, 1.7) as likely as the bifocal patients, to suffer myopic progression during the period of follow-up. (8 refs.)

68946 Evolutionary links between apposition and superposition optics in crustacean eyes. D.-E.Nilsson (Dept. of Zoology, Univ. of Lund, Lund, Sweden).
Nature (GB), vol.302, no.5911, p.818-21 (28 April 1983).
Reports that the plantonic larvae of most euphausiids and decapods possess a transparent type of apposition eye, designed for plantonic life, that is pre-adapted for superposition optics. This discovery suggests that the evolution of superposition eyes in crustaceans has its origin in the special apposition optics founding the larval eyes, thus providing the first evidence of an evolutionary link between apposition and superposition optics. (18 refs.)

Use of an ophthalmoscope for objective refraction of noncooperative patients ....See Entry 68991

Characteristics of a video-type pupillometer .... See Entry 68992

A model to explain the effect of soft lens design specifications on movement ....See Entry 69055

Validation of a model describing soft lens movement as a function of lens specification ....See Entry 69056

Effect of X-Chrom lens wear on chromatic discrimination and stereopsis in color-deficient observers .... See Entry 69057

87.32E Physiology of the eye; nerve structure and function

68947 Speculations on the direction of the optic nerve. T.D.Williams (School of Optometry, Univ. of Waterloo, Waterloo, Ontario, Canada).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.303-7 (April 1983).
A theory is proposed to explain the direction of the optic nerve on the basis of differing embryonic growth of axons on opposite sides of the nerve head. Several ophthalmoscopic indicators of the direction of the optic nerve are discussed. Some clinical implications are presented. (14 refs.)

An adaptive control model for human head and eye movements while walking ....See Entry 68953

87.32L Light detection; adaptation and discrimination

Fourier transform infrared difference spectra of intermediates in rhodopsin bleaching ....See Entry 68927

87.32N Colour detection; adaptation and discrimination

Effect of X-Chrom lens wear on chromatic discrimination and stereopsis in color-deficient observers .... See Entry 69057

87.32S Psychophysics of vision, visual perception, binocular vision

68948 Rapid calculation procedures for the maximum-likelihood method of adaptive psychophysics. B.R.Shelton (Univ. of Western Ontario, London, Ontario, Canada).
Behav. Res. Methods & Instrum. (USA), vol.15, no.1, p.87-8 (Feb. 1983).
Describes calculation methods for psychophysical experiments in which the response of the subject determines parameters of subsequent trial presentations. Two subroutines are provided. They are fast enough to complete calculations for the maximum likelihood procedure so that it can be used in experiments. (6 refs.)

68949 3D TV. T.Kitani (Wireless Res. Lab., Matsushita Electric Industrial Co. Ltd., Osakai, Japan).
J. Inst. Telev. Eng. Jpn. (Japan), vol.36, no.12, p.1051-9 (Dec. 1982). In Japanese.
The basic principles of stereo vision are described from the point of view of perception with conditions which permit binocular vision differences. A stereo imaging and TV system is shown and basic parameters are derived. The handling of the display of two image sets is illustrated with the example of a separately polarised images system. The use of PLZT glasses, a stereo video game (Zega Enterprises), computer graphics (Matsushita US), Sony stereo TV and multiprojection, autostereoscopy, the software for 3D TV as used by Tokyo Univ. and GENISCO are described. (23 refs.)

68950 Binoculear stereopsis in an insect. S.Rossel (Dept. of Zoology, Univ. of Zurich, Zurich, Switzerland).
Nature (GB), vol.302, no.5911, p.821-2 (28 April 1983).
Binocularity in insects is generally assumed to have the same function as in many vertebrates-the perception of depth. Evidence for this hypothesis stems from the observation that one-eyed dragonfly larvae, tiger beetle, praying mantids and water scorpions rarely catch prey, but no definitive evidence is available. Depth perception and catching behaviour depend on visual attention and visual behaviour and it is difficult to assess what is impaired when one eye is occluded. A more promising approach to studying the importance of binocular disparity is one that does not interfere with normal binocular vision, and allows potential monocular depth cues to be controlled carefully. These criteria were met in the present study by the use of prismatic lenses placed in front of the compound eyes of the praying mantis, thus creating a conflict between binocular disparity and mononuclear cues. The results demonstrate that mantids do indeed rely on binocular triangulation when estimating the distance of prey, and thus provide the first unequivocal evidence for stereoscopic vision in an invertebrate. (13 refs.)

Effect of X-Chrom lens wear on chromatic discrimination and stereopsis in color-deficient observers .... See Entry 69057

87.34 AUDITION

68951 Infant intermodal speech perception is a left-hemisphere function. K.MacKain (Dept. of Psychiatry, Cornell Univ. Medical Coll., New York, NY, USA), M.Studdert-Kennedy, S.Spieker, D.Stern.
Science (USA), vol.219, no.4590, p.1347-9 (18 March 1983).
Prelinguistic infants recognized structural correspondences in acoustic and optic properties of synchronized, naturally spoken disyllables, but did so only when they were looking to their right sides. This result suggests that intermodal speech perception is facilitated by rightward orientation of attention and subserved by the left hemisphere. (9 refs.)

Rapid calculation procedures for the maximum-likelihood method of adaptive psychophysics .... See Entry 68948

Brain function monitoring: a new method for simultaneous recording and processing of EEG-power spectra and brainstem potentials (BAEP) .... See Entry 69032

Design and fabrication of an experimental cochlear prosthesis .... See Entry 69059

A programmable multiple-tone generator .... See Entry 69062

A low-cost solid state device for producing delayed auditory feedback .... See Entry 69063

An audiometer with automatic frequency selection .... See Entry 69086

87.36 SPEECH

(see also 43.70 Speech communication)

Infant intermodal speech perception is a left-hemisphere function .... See Entry 68951

87.38 MECHANO- AND CHEMIO-CEPTIONS

(inc. biosonic generation, detection and guidance)

68952 An introduction to the application of system identification techniques to elements of the neuromuscular system. J.R.Rosenberg, D.J.Murray-Smith, A.Rigas (Univ. of Glasgow, Glasgow, Scotland).
Trans. Inst. Meas. & Control (GB), vol.4, no.4, p.187-201 (Oct.-Dec. 1982). [received: April 1983]
A simplified account of the organisation of the neuromuscular system is presented. An important component of this system, the 'muscle spindle', is a complex sensor that responds to imposed length changes and is thought to provide information which is important in the control of movement and in the maintenance of posture. The structure of the muscle spindle and its response to various inputs are described. The multi-input and multi-output nature and nonlinear behaviour of the muscle spindle are emphasised, both in terms of continuous and pulse-coded quantities. The methods of preprocessing of pulse-coded signals from nerves, and the identification techniques currently applied by neurophysiologists for the estimation of the parameters of linearised models of the muscle spindle, are presented and assessed. New developments in the identification on point-process systems are shown to be applicable to some aspects of muscle-spindle behaviour. This approach, based upon point-process parameters, is applied to an analysis of the output signal of a muscle spindle under a variety of input conditions and to the estimation of a transfer function of the muscle spindle subjected to a point-process input. A description of one nonlinearity and the effects of an additional input are also presented. (65 refs.)

System identification of the blood pressure control system by low frequency neural stimulation .... See Entry 68976

Electrocutaneous code pairs for artificial sensory communication systems .... See Entry 69058

Tilt-table/ankle-actuator system for the study of vestibulospinal reflexes .... See Entry 69083

87.40 BIOMAGNETISM

(inc. magnetocardiography)

In vivo phosphorus-31 nuclear magnetic resonance reveals lowered ATP during heat shock of Tetrahymena .... See Entry 68935

Magnetocardiographic observations of the human heart .... See Entry 68990

An introduction to NMR imaging: from the Bloch equation to the imaging equation .... See Entry 68995

Ferritin as a label for high-gradient magnetic separation .... See Entry 69065

87.45 BIOMECHANICS, BIORHEOLOGY, BIOLOGICAL FLUID DYNAMICS

68953 An adaptive control model for human head and eye movements while walking. J.D.McDonald, A.T.Bahill, M.B.Friedman (Carnegie-Mellon Univ., Pittsburgh, PA, USA).
IEEE Trans. Syst., Man & Cybern. (USA), vol.SMC-13, no.2, p.167-74 (March-April 1983).
When a person walks the head undergoes horizontal and vertical rotations, and also horizontal and vertical translations. To visually fixate on an object while walking, compensatory horizontal and vertical eye movements must be made. The model for this gaze (head plus eye) control system includes three types of eye movements: smooth pursuit, saccadic, and vestibulo-ocular. The smooth pursuit system uses a target-selective adaptive controller that compensates for the large inherent time delay and produces zero-latency tracking of predictable targets. Target movements were selected to minimize the role of the saccadic control system. Typical tracking is shown while seated with the head restrained, standing with unrestrained head, performing voluntary head rotations, and walking. Each additional degree of freedom produced additional head movements that were compensated by additional eye movements. It is shown that while a human walks the effects of head rotations (yaw) cancel the effects of head translations, thus minimizing the resulting horizontal eye rotations necessary to maintain fixation. (33 refs.)

68954 Quasisteady arterial blood flow. P.Gordon (Dept. of Math. Sci., Purdue Univ., Hammond, IN, USA).
J. Math. Phys. (USA), vol.24, no.4, p.1001-10 (April 1983).
Fluid flow through a bifurcating system of elastic tubes is modeled with the inviscid compressible time-dependent equations of fluid flow. Because of the physical scale of the problem (the length of the tube is large relative to its diameter), quasisteady analysis can be applied to the system of hyperbolic first order partial differential equations. Several simplified models are thereby obtained. Although similar in some respects to the usual incompressible models, the quasisteady models are seen to be significantly different. For example, the sound speed of the fluid remains an important parameter in the boundary condition. Numerical solutions are obtained for various problems. Results are presented for the one-layer problem, which was studied in some depth, and a three-layer problem, in which the layers are connected by bifurcation boundary conditions. The solutions are shown to be physically reasonable. Of special interest is the clear display of the mechanism in the model by which the elastic wall converts the pulsatile flow to a much more continuous outflow. (22 refs.)

68955 Gas mixing within the acinus of the lung. L.A.Engel (Thoracic Medicine Unit, Westmead Hospital, Sydney, Australia).
J. Appl. Physiol. (USA), vol.54, no.3, p.609-18 (March 1983).
The subject is reviewed with an emphasis on recent developments in model analyses. Application of computer technology has facilitated the study of simultaneous convection and diffusion within a complex geometry approximating the airways and air spaces of the lung. During an inspiration of fresh gas the diffusion front separating inspired from 'alveolar' gas is stationed within a portion of the acinus where the magnitudes of gas transport by convection and diffusion are similar. This constitutes the peripheral boundary of the Fowler dead space. Asymmetry of intra-acinar branching results in an inequality of gas concentrations within alveolar gas, despite homogeneous volume expansion. This is due to an interaction between diffusion and convection at branch points subtending units of unequal lengths. During a respiratory cycle a 'diffusive Pendelluft' between these units results in a 'first in-first out' pattern and a sloping alveolar plateau on the expired tracing, despite synchronous and homogeneous volume changes. Experimental results suggest that incomplete alveolar gas mixing constitutes a measurable limitation to gas exchange in the normal lung. (56 refs.)

68956 Effect of height on alveolar liquid pressure in isolated edematous dog lung. K.C.Beck, J.Lai-Fook (Div. of Thoracic Diseases & Internal Medicine, Mayo Clinic, Rochester, MN, USA).
J. Appl. Physiol. (USA), vol.54, no.3, p.619-22 (March 1983).
Micropipettes were used in conjunction with a servo-nulling system to measure alveolar liquid pressure (Pliq) in 'free' liquid spaces 0.1-1.0 mm beneath the pleural surfaces of excised dog lung lobes. Lobes were mounted with the long axis vertical, held at constant transpulmonary pressure (Ptp), perfused with plasma, and made edematous by raising vascular pressure. Pliq was measured at two sites, near the top (apical) and bottom (basal) surfaces, about 8-10 cm apart in height, and wet (W) to dry (D) weights for the top and bottom sections were obtained in two groups of five lobes, one at Ptp of 5 cmH_2O and the other at Ptp of 15 cmH_2O. At Ptp of 5 cmH_2O, there was no significant difference (mean±SD) between apical (2.4±0.5 cmH_2O) or basal Pliq values (2.2±0.9 cmH_2O) relative to pleural pressure. At Ptp of 15 cmH_2O, basal Pliq values (3.9±1.4) were always more positive than apical Pliq values (2.0±1.6), an indication of more liquid at the lung base. (24 refs.)

68957 Adaptation of vascular pressure-flow-volume hysteresis in isolated rabbit lungs. K.C.Beck, J.Hildebrandt (Dept. of Physiology & Biophys., Univ. of Washington, Seattle, WA, USA).
J. Appl. Physiol. (USA), vol.54, no.3, p.671-9 (March 1983).
Hysteresis within two pairs of variables describing the state of the lung vascular system [pulmonary arterial pressure (Ppa) and flow ($\dot{Q}$) and Ppa and change in vascular volume (ΔVvasc)] was investigated in isolated plasma-perfused rabbit lungs. $\dot{Q}$ was increased and decreased stepwise, in series of five cycles each, while pulmonary venous pressure (Ppv) and lung volume were held constant. Changes in Vvasc were estimated from changes in fluid volume of the venous reservoir. The relationships within pairs of variables over each complete cycle were described by loops whose areas and widths were used to quantify the hysteresis. In successive cycles, these parameters decreased toward constant values (limit cycles), most of the change occurring by the second cycle. Areas of Ppa-$\Delta\dot{V}$vasc loops correlated closely with areas of Ppa-$\dot{Q}$ loops over all five cycles of a series. For Ppa-$\dot{Q}$ loops, the ratio of average pressure-width to total pressure excursion decreased from 0.15 initially to around 0.05 in the fifth cycle. It was concluded that the relationships between Ppa and $\dot{Q}$ and Ppa and ΔVvasc are markedly sensitive to vascular pressure or flow history. (35 refs.)

68958 Partitioning of respiratory mechanics in ansthetized cats. W.A.Zin, L.D.Pengelly, J.Milic-Emili (Meakins-Christie Labs., McGill Univ., Montreal, Quebec, Canada).
J. Appl. Physiol. (USA), vol.54, no.3, p.708-13 (March 1983).
In five spontaneously breathing anesthetized cats (pentobarbital sodium 35 mg/kg), airflow, changes in lung volume, and tracheal, transpulmonary, esophageal, and gastric pressures were measured. The airways were occluded at end inspiration (V_T). During the ensuing period of apnea (Breuer-Hering inflation reflex), the animal relaxed the respiratory muscles, and passive elastance of the respiratory system, lung, and chest wall were computed by dividing tracheal, transpulmonary, and esophageal pressures, respectively, by V_T. With the animal still relaxed, the airways were reopened, and during the ensuing relaxed expiration, pressure-flow relationships were determined for the respiratory system, lung, and chest wall. A linear relationship was found for the former, whereas power functions best described the others. While the pulmonary pressure-flow relationship exhibited an upward concavity, that for the chest wall presented an upward convexity. Chest wall resistance increased with decreasing lung volume; this may reflect asynchronous emptying of rib cage and abdomen-diaphragm and volume dependence of chest wall resistance. (20 refs.)

68959 Determination of forces in extensor pollicis longus and flexor pollicis longus of the thumb. K.N.An, W.P.Cooney, E.Y.Chao, L.J.Askew, J.R.Daube (Orthopedic Biomech. & Electromyography Labs., Mayo Clinic, Rochester, MN, USA).
J. Appl. Physiol. (USA), vol.54, no.3, p.714-19 (March 1983).
A mathematical model was developed to calculate internal forces in the thumb. The solution was indeterminate, since the number of unknown forces exceeded the equations available in the static force analysis. To resolve the problem, the muscle forces were obtained in conjunction with quantitative electromyographic data. The relationship between muscle force and integrated electromyograms (IEMG) were obtained in terms of polynomial function. A multiple-polynomial regression analysis of the measured force and IEMG data was used to determine the correlation coefficients. Then the muscle forces were calculated with the thumb performing tip, key, and pulp pinches and grasp. The muscle forces were found to be in the range of 3-120 N for the flexor pollicis longus and 4-40 N for the extensor pollicis longus. (20 refs.)

68960 Lobar flow patterns in a hollow cast of canine central airways. B.Snyder, M.J.Jaeger (Dept. of Physiology, Coll. of Medicine, Univ. of Florida, Gainesville, FL, USA).
J. Appl. Physiol. (USA), vol.54, no.3, p.749-56 (March 1983).
To demonstrate that the regional partitioning of flow in central airways is direction dependent, the authors compared inspiratory and expiratory lobar flows in a hollow rigid cast of canine lungs. Lobar flows were measured by a hot-wire anemometer, simultaneous tracheal flows by a pneumotachograph, and data displayed as (lobar) flow-(tracheal) flow curves. For tracheal airflows between 50 and 370 ml/s, the authors found that inspiratory apical flows were smaller, and basal flows larger, than corresponding expiratory distributions. This effect was largely extinguished by substituting a gas mixture of 85% He-15% N_2; resulting regional flows were comparable to expiratory distributions obtained on room air. Thus canine central airways structure induces a kinematically irreversible flow pattern, consistent with a model of 'cascade flow' in which branching structure modifies the distribution only of inspiratory flow. These results support Fowler's (1949) concept that lung regions fill and empty sequentially and may be pertinent to analyses of regional washout. (24 refs.)

68961 Total airway resistance and respiratory muscle activity during sleep. J.M.Lopes, E.Tabachnik, N.L.Muller, H.Levison, A.C.Bryan (Respiratory Physiology, Res. Inst., Hospital for Sick Children, Toronto, Ontario, Canada).
J. Appl. Physiol. (USA), vol.54, no.3, p.773-7 (March 1983).
Total airway resistance (Raw) and inspiratory muscle activity was measured in five normal adults during sleep. Flow was derived by electronically differentiating a volume signal obtained with a respiratory inductive plethysmograph. Esophageal and abdominal pressures were measured with a standard balloon technique, and electromyograms (EMG) of the intercostal muscles and diaphragm were recorded with surface electrodes. Changes in Raw were sleep state dependent. Raw increased by a mean of 230% during non-rapid-eye-movement sleep (NREM) compared with wakefulness. During rapid-eye-movement (REM) sleep mean values were comparable to the ones measured during wakefulness. Intercostal EMG activity increased by 34% from wakefulness to NREM sleep. At the same time, transdiaphragmatic pressure (Pdi) increased by a mean of 20% despite no change in diaphragmatic EMG activity, indicating an increase in muscle efficiency. From NREM to REM sleep diaphragmatic EMG increased by 30%, but despite the increase in diaphragmatic activity, mean Pdi values were 10% lower during this sleep state, indicating a decrease in muscle efficiency. It is concluded that changes in total airway resistance, probably related to a decrease in upper airway muscle tone, lead to an increase in the work of breathing during sleep. (20 refs.)

68962 Mechanical properties of alveolar wall after pneumonectomy and ozone exposure. C.J.Martin, E.S.Boatman, G.Ward (Virginia Mason Res. Center, Seattle, WA, USA).
J. Appl. Physiol. (USA), vol.54, no.3, p.785-8 (March 1983).
The mechanical properties of the alveolar wall were studied in rabbits intermittently exposed to 0.4 ppm ozone (O_3) for 210 h. Compared with age-matched controls, those exposed had greater extensibility of the tissue before deformation (yield) and break, greater energy loss with length-tension cycling (hysteresis), and a lower stress at an extension of 1.5 times resting length. O_3 exposure appeared to increase the freedom of connective tissue fibers. After a pneumonectomy, a similar O_3 exposure did not alter these properties in comparison with unexposed rabbits with pneumonectomy. Lung growth protected the animal against the O_3-induced change in tissue properties. Mechanical properties of alveolar walls removed from the lung remaining after pneumonectomy were similar to those from unoperated controls. Despite the marked growth of connective tissue fibers these tissues were similar in maximum extensibility, viscoelastic properties, and the stress developed in extension. (23 refs.)

68963 Alveolar size as a determinant of pulmonary distensibility in mammalian lungs. P.S.Haber, H.J.H.Colebatch, C.K.Y.Ng, I.A.Greaves (Dept. of Thoracic Medicine, Univ. of New South Wales, Little Bay, New South Wales, Australia).
J. Appl. Physiol. (USA), vol.54, no.3, p.837-45 (March 1983).
Pulmonary distensibility depends on surface tension and tissue elastic forces, but the relative contribution of each to total lung recoil remains incompletely defined. By applying an exponential analysis to static pressure-volume curves obtained from the excised lungs of cats, dogs, and rats with air and saline filling, the exponential constant K (an index of lung distensibility) was related to the mean linear intercept L_m (a morphometric estimate of the mean size of peripheral air spaces at maximal inflation). K for air filling (K_a) was unrelated to K for saline filling (K_s), and K_s was unrelated to L_m, but similar highly significant regressions of K_a on L_m were found in each species, and the common regression was similar to that described previously for human lungs. Approximately 86% of the variance in lung distensibility (K_a) within and between species was explained by L_m. Because L_m determines the size of air spaces, and therefore the alveolar surface-to-volume ratio, the findings indicate that the density of surface forces is the major determinant of lung distensibility in the air-filled state. (37 refs.)

68964 A model for the calculation of mechanical power during distance running. K.R.Williams (Dept. of Phys. Education, Univ. of California, Davis, CA, USA), P.R.Cavanagh.
J. Biomech. (GB), vol.16, no.2, p.115-28 (1983).
Because widely varying estimates of mechanical power have been calculated for a given speed of running by previous investigators, the effects of various assumptions necessary for mechanical power calculations were evaluated via a segmental energy analysis using 3-D cine data from 31 well-trained subjects running overground at 3.57 $m\ s^{-1}$. The magnitude of power calculated was very dependent upon assumptions involving the amount of between segment energy transfer occurring, the relative metabolic cost of positive vs. negative work, the amount of the total negative work attributed to muscular work, the effects of elastic storage of energy and on the choice of cutoff frequency in filtering the coordinate data. Mechanical power values ranged from 273 to 1775 W depending on the particular assumptions made and computational methods employed giving efficiency ratios from 0.31 to 1.97. These results point to a need for more definitive research into the role played by energy transfer, negative work, and elastic storage of energy before confidence in measured mechanical power can be established. (28 refs.)

68965 Geometric properties of equine metacarpi. G.Piotrowski (Dept. of Mech. Engng., Univ. of Florida, Gainesville, FL, USA), M.Sullivan, P.T.Colahan.
J. Biomech. (GB), vol.16, no.2, p.129-39 (1983).
Paired equine metacarpals were harvested, cleaned and sectioned transversely every 20 mm, and the bone geometry analyzed with a computer program. The cross-sectional area is largest in the middle third of the bone, and tapers off at either end. The principal axes are typically within 15° of the anatomical axis, with the distal end rotated internally relative to the proximal end. At midshafts the bending stiffness in the antero-posterior plane is about 2/3 of the stiffness in the medio-lateral plane. The torsional stiffness is highest proximally. The equine third metacarpal appears to be designed to resist axial compression and mediolateral bending very well, and exhibits uniform resistance to torsion along its length. (16 refs.)

68966 Three-dimensional visualisation of velocity profiles in the ascending aorta in dogs, measured with a hot-film anemometer. K.P.Paulsen, J.M.Hasenkam (Dept. of Thoracic & Cardiovascular Surgery, Aarhus Univ. Hospital, Aarhus, Denmark).
J. Biomech. (GB), vol.16, no.3, p.201-10 (1983).
Three-dimensional blood velocity profiles were registered in the ascending aorta of dogs approximately 2 and 5 cm above the aortic valves by means of constant temperature hot-film anemometry. The velocity was measured at 41 predetermined points of measurement evenly distributed over the cross-sectional area. Later data analyses using a three-dimensional plotting system, visualised velocity profiles at 200 time intervals during one mean heart cycle. The overall appearance of the profiles was that of a flat transitional flow with a slight skewness. The highest velocity was found nearer to the posterior and left vessel wall. The skewness started during top systole and persisted to the beginning of diastole. Furthermore, many small velocity fluctuations were seen during top systole, but they might also be caused by secondary rotational flow phenomena. This new three-dimensional and dynamic method for visualising velocity profiles seems to offer advantages, as it demonstrates the total velocity profile all over the cross-sectional area. (16 refs.)

68967 Radial bulging of the annulus fibrosus during compression of the intervertebral disc. J.A.Klein, D.S.Hickey, D.W.L.Hukins (Dept. of Medical Biophys., Univ. of Manchester, Manchester, England).
J. Biomech. (GB), vol.16, no.3, p.211-17 (1983).
An analysis of the bulging of the annulus fibrosus as a function of the height of the intervertebral disc during compression is presented. The theory was compared with the results of experimental tests on rabbit lumbar discs. When viewed in profile the ventral bulge closely resembled an arc of a circle; at each stage of compression it appeared to extend from the cranial to the caudal extremities of the annulus fibrosus. The radius of curvature of the arc was measured as a function of disc height and the results compared with theoretical predictions. Good agreement was obtained if it was assumed that about half the volume change swept out by the approach of the cranial and caudal end-plates was accommodated by the annular bulge. The lengths of the collagenous fibres reinforcing the outer lamella of the ventral annulus were estimated from the dimensions of the ventral bulge; no appreciable length increase appeared to accompany compression. (25 refs.)

68968 Normative data of knee joint motion and ground reaction forces in adult level walking. E.Y.Chao, R.K.Laughman, E.Schneider, R.N.Stauffer (Dept. of Orthopedics, Mayo Clinic, Rochester, MN, USA).
J. Biomech. (GB), vol.16, no.3, p.219-33 (1983).
A normative data base of temporal distance factors, knee joint motion and ground reaction force patterns for 148 adults during level walking is reported. The data were studied using parametric and non parametric (Fourier series) representations to facilitate statistical analyses. Key parameters were divided according to age and sex. Individual force and motion curves of each normal subject were averaged to establish the 'typical' patterns. All typical patterns were combined to construct the 'general' patterns. The essential number and most significant Fourier coefficients were determined. It was found that the sex-related variation is more significant than the age-related variation in adult gait. This data base can serve as a common reference for comparison. (55 refs.)

68969 Mathematical model of the human ankle joint. G.T.Wynarsky, A.S.Greenwald (Cleveland Res. Inst., St. Vincent Charity Hospital, Cleveland, OH, USA).
J. Biomech. (GB), vol.16, no.4, p.241-51 (1983).
It has been suspected that the mechanical environment in which a particular joint functions has an effect on the initiation or progression of degenerative joint disease. The objective of this study is to define the mechanical environment of the ankle joint, specifically, the contact areas and pressure distributions, through the development and analysis of a simplified mathematical model. Since the state of pressure across articular surfaces during function is influenced by joint incongruity, cartilage thickness profile and the geometry of the opposing surfaces, these factors have been incorporated into the model formulation. Mathematical analysis of the model has resulted in pressure distributions in both the anterior-posterior and medial-lateral directions and contact area growth plots which correlate well with observed ankle contact patterns obtained from in vitro investigations. The significance of joint incongruity to these pressure distributions and to the relative immunity of the ankle joint to primary osteoarthritis is discussed. (15 refs.)

68970 Two-dimensional dynamic modelling of human knee joint. M.H.Moeinzadeh (Dept. of General Engng., Univ. of Illinois, Urbana, IL, USA), A.E.Engin, N.Akkas.
J. Biomech. (GB), vol.16, no.4, p.253-64 (1983).
A mathematical dynamic model of the two-dimensional representation of the knee joint is presented. The profiles of the joint surfaces are determined from X-ray films and they are represented by polynomials. The joint ligaments are modelled as nonlinear elastic springs of realistic stiffness properties. Nonlinear equations of motion coupled with nonlinear constraint conditions are solved numerically. Time derivatives are approximated by Newmark difference formulae and the resulting nonlinear algebraic equations are solved employing the Newton-Raphson iteration scheme. Several dynamic loads are applied to the centre of mass of the tibia and the ensuing motion is investigated. Numerical results on ligament forces, contact point locations between femur and tibia, and the orientation of tibia relative to femur are presented. The results are shown to be consistent with the anatomy of the knee joint. (26 refs.)

68971 The forces and couples in the human trunk during level walking. A.Cappozzo (Lab. of Biomech., Univ. degli Studi, Roma, Italy).
J. Biomech. (GB), vol.16, no.4, p.265-77 (1983).
The intersegmental force and couple exchanged between upper and lower body across a transverse section passing through the fourth lumbar vertebra were estimated during level walking on a straight line at speeds ranging from 0.99 to 2.23 ms^{-1}. This was done using 3-D kinematic information relative to the head, upper limbs, and upper torso, obtained through a stereophotogrammetric technique, and the relevant inertial parameters obtained using anthropometric measurements and estimation techniques provided in the literature. Twenty walking cycles of five normal adult male subjects were analysed. The intersegmental force and couple components are presented as referenced to both a laboratory and pelvic set of axes. Using these results some considerations are made concerning the variations which the overall trunk muscles effort undergoes because of mean walking speed changes. The muscular action on the trunk is inferred from the intersegmental couple components. The various factors that contribute to the build-up of the intersegmental force and couple are analysed and their relative importance assessed. (30 refs.)

68972 The effect of blood flow phenomena on oxygenation efficiency. Tze-Wen Chung, Chau-Jen Lee (Dept. of Chem. Engng., Nat. Tsing Hua Univ., Hsinchu, Taiwan).
J. Chin. Inst. Eng. (Taiwan), vol.6, no.1, p.51-5 (Jan. 1983).
The effect of blood flow on the oxygenation efficiency was studied by using a single-tube silicone rubber membrane oxygenator. The ranges of flow covered the regions, of laminar, turbulent, and secondary flow. The existence of hemoglobin in the blood actually enhances the rate and capacity of oxygen carried by the blood. Mass transfer equations which involved turbulent eddy diffusivity were numerically solved for radial as well as axial profiles in terms of the degree of oxygen saturation. Further investigation on the effect of turbulent and secondary flow is still being undertaken. (6 refs.)

68973 Comparison of computer models of the human arterial system for the assessment of clinical data. P.R.Bourne (Dept. of Bioengng., St. Thomas's Hospital, London, England), R.I.Kitney.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.319-23 (May 1983).
Arterial pressure and flow measurements can be analysed using a mathematical model of the circulation. A comparison of four models of the circulation used in this way is presented. The results indicate some criteria for evaluating circulation model performance in general. (13 refs.)

68974 Dynamic simulation of the renal medulla. G.L.Barrett, J.S.Packer (Dept. of Electrical Engng., Univ. of Melbourne, Parkville, Victoria, Australia).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.324-32 (May 1983).
The operation of the urinary concentrating system is intimately linked to the complex and distinctive anatomy of the renal medulla, and research into the concentrating mechanism has stimulated considerable endeavour in modelling of the process. The paper presents a dynamic model of the renal medulla which attempts to describe concentrations and axial flows in two sets of tubes, one comprising the loop of Henle and collecting duct and the other comprising the descending and ascending vasa recta, and in the interstitial space. Particular attention is given to modelling of the characteristics of the inner medulla. The model allows for the tapering of the inner medulla towards the papilla, the union of collecting ducts and the fact that nephrons and vascular loops turn back at various depths so that only a small portion of them reach the papilla. The inclusion of this detail in the model leads to a good representation of the concentrating mechanism and the model provides a good basis for the study of phenomena such as sodium reabsorption. (21 refs.)

68975 Online identification of mechanical parameters of the lung. D.A.Linkens, S.J.Rimmer (Dept. of Control Engng., Univ. of Sheffield, Sheffield, England).
Trans. Inst. Meas. & Control (GB), vol.4, no.4, p.177-85 (Oct.-Dec. 1982). [received: April 1983]
Discusses the use of a microcomputer for online estimation of mechanical parameters of the lungs. The identification is based on measurements of airflow at the mouth using a pneumotachograph and oesophageal pressure obtained via a balloon catheter. A simple mathematical model for lung mechanics is used which includes terms for airways resistance, dynamic pulmonary compliance and a nonlinear turbulence factor. The method of identification is a steepest-descent gradient algorithm based on equation-error formulation of the problem. Recently, the estimation algorithm has been transferred to a Research Machines 380Z microcomputer and applied to neo-natal data for rapid assessment of apnoea. Two versions of programs have been implemented, one of which gives an online printer listing of lung parameters based on either inspiratory or expiratory data. The other version uses four DAC channels to give analogue chart recording data. Examples are shown of simultaneous six-channel recordings comprising the primary pressure and flow signals, estimated airways resistance and pulmonary compliance, tidal volume and minute volume. The effect of apnoea on these parameters, together with heart rate, can be assessed using this online identification method. (7 refs.)

68976 System identification of the blood pressure control system by low frequency neural stimulation. R.I.Kitney, C.M.Gerveshi (Dept. of Electrical Engng., Imperial Coll., London, England).
Trans. Inst. Meas. & Control (GB), vol.4, no.4, p.203-12 (Oct.-Dec. 1982). [received: April 1983]
Describes the identification of the control structure of that section of the blood pressure control system which relates cardiac depressor activity to heart rate, arterial blood pressure and respiration. Using pulse frequency modulated PRBS techniques, the parameters of the closed loop frequency and impulse responses of the baroreceptor (pressure transducer) control loop were estimated, thereby gaining a more detailed understanding of the dynamics of the baroreceptor system. (14 refs.)

68977 Second-grade fluid film lubrication in Hertzian contacts with reference to synovial joints. K.M.Nigam, N.M.Bujurke, M.P.Singh, K.Manohar (Centre for Atmospheric & Fluids Sci., Indian Inst. of Technol., New Delhi, India).
Wear (Switzerland), vol.84, no.3, p.261-74 (1 Feb. 1983).
An analysis of squeeze film lubrication between two approaching surfaces is presented with reference to normally loaded human joints. A second-grade fluid represents the synovial fluid in the region between the approaching surfaces. Analytical expressions for the pressure distribution, load-carrying capacity and time of approach between any two film thicknesses are derived. The normalized pressure as well as the average pressure increase with an increase in the non-newtonian dimensionless parameter N_n. With normal young synovial fluid the pressure developed in the joint cavity is considerably greater than with normal old and osteoarthritic synovial fluid. Pressure variation is least around the centre and exit of the surfaces and largest in the intermediate region. The rate of variation in the intermediate region is large for larger values of the minimum film thickness h_0. The rate of variation in the load-supporting capacity is smaller for larger values of h_0 in contrast with the intermediate range of values of h_0 for which it is larger. The times of approach for osteoarthritic and old normal synovial fluid are smaller than the time of approach for healthy normal young synovial fluid and this partly accounts for increased cartilage wear in old osteoarthritic patients. (13 refs.)

68978 The prediction of pathologic fracture in patients with metastatic cancer. E.Buturla, C.Hawkins, D.Seligson, Pope. M.H. (Dept. of Orthopaedics & Rehabilitation, Univ. of Vermont, Burlington, VT, USA).
16th Annual Simulation Symposium. Record of Proceedings, Tampa, FL, USA, 16-18 March 1983 (New York, USA: IEEE 1983), p.33-9
Application of finite element modeling has provided greater understanding of load transmission and shear properties throughout the femur. Oonishi and Hasegawa (1982) used a two-dimensional finite element analysis to investigate different stress properties of cortical and cancellous bone regions of the femur, intuitively, because of the femur is asymmetrical and curved in each planar axis one would expect a three-dimensional model to be more generalizable to a real-world situation. Crowninshield (1980) developed a useful 3-D model to resolve geometrical problems incurred with total hip reconstruction. With this model, as any finite element analysis, a greater number of nodal points and elements yields a more accurate resolution of load stress/displacements. The present study utilized these and other factors in simulating a femur presenting metastatic lesions of the sub- and intertrochanteric regions. Removal of elements in these areas along with their inherent stiffness support properties to the model thus simulated the effect of nonsupportive tumor within otherwise healthy bone. (23 refs.)

Sixth Annual Conference of the American Society of Biomechanics (papers in summmary form only received) ....See Entry 64578

Heterogeneous bubble nucleation and conditions for growth in a liquid-gas system of constant mass and volume [bone cell application] .....See Entry 67177

Description and application of an ultrasonic Doppler velocimeter for the small vessels ....See Entry 68988

Measurement of changes of blood flow in renal transplants ....See Entry 69000

Inadequate dynamic response of catheter-transducer systems, a source of error in direct blood pressure measurement ....See Entry 69031

A simple method of measuring the footsole pressure of normal subjects using Prescale pressure-detecting sheets ....See Entry 69036

Artefact encountered by the vibration detection system ....See Entry 69037

Microprocessor-based system for the measurement and analysis of an expiratory flow-volume curve ....See Entry 69040

The 'Hollywood gaitrack': a method for measuring temporal and distance factors of gait ....See Entry 69042

Problems of haemodynamic monitoring encountered in intensive care ....See Entry 69046

A device for the electrical measurement of the deformability of red blood cells ....See Entry 69061

Estimation of effective pulmonary capillary pressure in intact lungs ....See Entry 69078

A procedure for determining angular positional data relative to the principal axes of the human body ....See Entry 69079

Arterial tonometry: review and analysis ....See Entry 69080

A constant stress creep testing machine ....See Entry 69081

Improved filtration method for red cell deformability measurement ....See Entry 69082

CoSTEL: a computer peripheral remote sensing device for 3-dimensional monitoring of human motion ....See Entry 69084

87.50 BIOLOGICAL EFFECTS OF RADIATIONS
(inc. effects of fields)

68979 Changes in cell shape and actin distribution induced by constant electric fields. P.W.Luther, H.B.Peng (Dept. of Anatomy, Univ. of Illinois Coll. of Medicine, Chicago, IL, USA), J.Jung-Ching Lin.
Nature (GB), vol.303, no.5912, p.61-4 (5 May 1983).
Describes a galvanotropic response of cultured Xenopus epithelial cells. At a field strength of $5\ \mathrm{V\ cm^{-1}}$ these cells elongate perpendicularly with respect to the field. The anodal side of the cell retracts and both the ends and cathodal edge become active in the extension of ruffling lamellipodia. In parallel with the change in the cell axis, stress fibres are oriented perpendicularly to the field, and a band of actin is associated with the lamellae at the cathodal edge and at the ends of the cell. (28 refs.)

87.50E Bio-optics (effects of microwaves, light, laser and other electromagnetic waves)

68980 Standards for use of visible and nonvisible radiation on the eye. D.H.Sliney (US Army Environmental Hygiene Agency, Aberdeen Proving Ground, MD, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.278-86 (April 1983).
Presently recommended exposure limits for optical radiation permit one to estimate the hazard to the eye and skin for continuous periods of exposure. They apply explicitly only to uninterrupted exposure—the so-called 'worst-case' condition. This paper examines the biological and practical aspects of human exposure to bright light which permit the application of 'use factors' where justified in the use of these exposure limits and considers the limitations of such limits. (17 refs.)

87.50G Ionizing radiations (u.v., X-ray, gamma-ray; particle radiation effects)

68981 Growth kinetics of Bp8 mouse ascites sarcoma after single doses of whole body irradiation. II. Analysis of the progression of cells through the cell cycle. S.Cao, S.Skog, B.Tribukait (Dept. of Medical Radiation Biology, Karolinska Inst., Stockholm, Sweden).
Acta Radiol. Oncol. Radiat. Therapy Phys. & Biol. (Sweden), vol.21, no.5, p.331-43 (1982).
For pt.I see ibid., vol.21, p.255, p.1982. A detailed analysis of the cell kinetics of X-irradiated ascites tumour is presented based on the data of pt.I. The durations of the mitotic delay, the G_1-depletion and the early G_2 blockage were linearly related to the dose. After release of the mitotic division delay the accumulation rate of cells in M and G_1 decreased linearly with the dose: for G_2, plateau values for the accumulation rate were found after 2.5 Gy. The outflow rates from G_2 and M after release of the G_2 blockage showed a shoulder type of dose-response with a D_0 of 2.5 Gy and a n value of 1.5. In addition to an increase in the duration of G_2, generally responsible for the increase in the total cell cycle time at about 24 hours after irradiation and an increase in the duration of the S-phase up to 12 hours after irradiation, an early increase in the duration of G_1 and M was observed. (29 refs.)

68982 Senescence behaviour gamma-irradiated detached Betel (Piper Betle L.) leaf. S.D.Mishra, B.K.Gaur (Biology & Agriculture Div., Bhabha Atomic Res. Centre, Bombay, India).
Curr. Sci. (India), vol.52, no.3, p.135-6 (5 Feb. 1983).
Deferral of senescence in betel leaf by mechanical manipulations like depetiolation was earlier reported. Such an effect of depetiolation-induced delay in senescence was later confirmed. Also, ionising radiations, as a physical means, are known to affect the shelf-life of many perishable commodities. The authors examine the role of gamma radiation in regulating the senescence in detached betel leaf. (13 refs.)

68983 Further experiments to study whether localised fission fragment irradiation of rat lung causes tumours. A.L.Batchelor, T.J.Jenner, L.M.Cobb (MRC Radiobiology Unit, Harwell, Didcot, England).
Phys. Med. & Biol. (GB), vol.28, no.5, p.475-83 (May 1983).
Male albino rats inhaled in aerosol of $^{235}UO_2$ (mass median aerodynamic diameter=2.8 μm and geometric standard deviation=1.6). Approximately 20 h or 7 d post-inhalation the rates were exposed briefly to 10^{12} slow neutrons cm^{-2} in a nuclear reactor, causing the retained $^{235}UO_2$ particles of approximation mass 40 or 400 μm to emit fission fragments were either 80 or 800 cGy approximately and in addition the lungs were exposed gave mean doses of about half that from the fission fragments. The animals were kept for their life-time and killed when they became moribund. Malignant tumours were found in the lungs (squamous cell carcinoma and adenocarcinoma) which were probably induced by the α-rays rather than the fission fragments. Because of insufficient numbers of animals in the experimental groups, however, some statistical uncertainty exists as to whether the fission fragments were in fact less effective than the α-rays per unit absorbed dose in causing malignant tumours of the lung. (8 refs.)

68984 Estimation of a single property of low LET radiations which correlates with biological effectiveness. D.T.Goodhead (MRC Radiobiology Unit, Harwell, Didcot, England), D.J.Brenner.
Phys. Med. & Biol. (GB), vol.28, no.5, p.485-92 (May 1983).
The biological effectiveness of ionizing radiation is believed to be related to the initial structure of the radiation tracks. In this paper, an attempt is made to identify a single physical property of the radiation field that correlates with relative biological effectiveness. This property has been sought in terms of a minimum amount of energy deposition in a certain volume. In order to quantify this approach detailed Monte Carlo track structure simulations have been made of X-rays of widely differing energies and the results have been compared with previously reported experiments of cell killing by these radiations. In terms of the above threshold energy concept, the authors have thus identified a putative critical property of radiations of low ionisation density such as X-rays, namely the rare occurrence of energy deposition of $\geq$100 eV in a volume of about 3 nm diameter. (29 refs.)

68985 The effect of radiation on bioluminescent bacteria: possible use of luminescent bacteria as a biological dosemeter. J.Mantel, M.Freidin (Dept. of Radiology, Sinai Hospital of Detroit, Detroit, MI, USA), A.A.Bulich, H.Perry.
Phys. Med. & Biol. (GB), vol.28, no.5, p.599-602 (May 1983).
Reports investigations on the response of the bioluminescent bacteria, Photobacterium phosphoreum, to radiation and the use of the bacteria as a biological radiation dosemeter. By the latter the authors mean a water-equivalent biological system that will compare beams not merely on the basis of absorbed dose, but also have intrinsic RBE values for different radiation beams. The authors studied the effect of low LET beams of different quality on the bioluminescent survival fraction and compare the RBE values obtained with those previously published. The results show that the smallest detectable dose at present is about 1 Sv. However, there are reasons to expect an improvement in sensitivity of the system by a factor of about two in the future. It is believed that the phenomenon of bacterial luminescence loss produced by radiation will contribute to clinical radiation dosimetry and research. (5 refs.)

68986 Thresholds in radiobiology. P.R.J.Burch, M.S.Chesters (Dept. of Medical Phys., Univ. of Leeds, Leeds, England).
Phys. Med. & Biol. (GB), vol.28, no.5, p.603-4 (May 1983).
R. Katz and W. Hofman (see ibid., vol.27, p.1187, 1982) attributed to the present authors and others 'suggestions of dose of LET thresholds in radiobiology'. The present authors feel that this statement is ambiguous, and in this reply they clarify their position. (5 refs.)

68987 Interaction of natural radioprotectants and gamma radiation in rabbit erythrocytes. M.Fernandez (Dept. de Fisica, Univ. de Chile, Santiago, Chile), I.Rojo, I.Tomicic, J.Toha.
Radiat. Eff. Lett. (GB), vol.68, no.5, p.131-8 (1983).
The protective capacity of vitamins such as niacinamide, riboflavine, vitamin K, thiamine and cyanocobalamine, the coenzymes NAD and FAD, the electron carrier cytochrome c and mixtures of these compounds in a molar concentration range between 10^{-6} M and 10^{-4} M were studied on gamma irradiated rabbit red blood cells. The dose relative factor (DRF 37) was evaluated by visible absorbancy measurements of the liberated hemoglobin. Some of the best DRF 37 obtained were: cytochrome c: 4.7; riboflavine: 4.0; cyanocobalamine: 3.6; thiamine: 3.5; vitamin K: 2.6; niacinamide: 2.0. (7 refs.)

Heavy ion induced desorption of biomolecules: dependence on the heavy ion parameters .... See Entry 68925

Mammalian spermatogenesis as a new system for biologic dosimetry of ionizing irradiation .... See Entry 69025

Experience from application of radiolyoluminescence and electron paramagnetic resonance to dosimetry of accidental irradiation .... See Entry 69029

87.60 MEDICAL AND BIOMEDICAL USES OF FIELDS, RADIATIONS, AND RADIOACTIVITY

(see also 28.80 Nuclear radiation technology, including shielding)

Proceedings of the 21st Annual Conference of the Electron Microscopy Society of Southern Africa .... See Entry 64591

87.60B Sonic and ultrasonic radiation

68988 Description and application of an ultrasonic Doppler velocimeter for the small vessels. D.Cathignol, J.Y.Chapelon, J.L.Mestas, C.Fourcade (CETAC INSERM, Bron, France).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.358-64 (May 1983). In French.
A detailed description is given of the use of a 20 MHz pulsed Doppler velocimeter. This choice of ultrasonic emission frequency gives axial and lateral resolution of ±0.15 mm. Various applications in vitro and in animal and man justify the development of this type of equipment, both for microsurgery and precision haemodynamic studies. (10 refs.)

68989 Computerized tomography with ultrasound. J.F.Greenleaf (Dept. of Physiology & Biophys., Mayo Foundation, Rochester, MN, USA).
Proc. IEEE (USA), vol.71, no.3, p.330-7 (March 1983).
The mathematical basis for transmission computed tomographic imaging using straight-line reconstruction equations is discussed. Both narrow-band and broad-band solutions are described. The Born and Rytov methods are discussed and the Rytov inversion equation presented with some results. Problems with implementation of the method are mentioned. Backscatter reconstruction methods of seismology are discussed as to their strengths and weaknesses for use in tissue imaging. (35 refs.)

87.60D Electric and magnetic fields (d.c. and pulsed)

68990 Magnetocardiographic observations of the human heart. C.Palmy (Neu-Technikum Buchs und U. Heinrich, Kantonsspital Winterthur, Germany).
Helv. Phys. Acta (Switzerland), vol.55, no.6, p.720-5 (1982).
Magnetic flux densities of a normal and of a diseased human heart were measured with a second-derivative SQUID-gradiometer. The magnetic signal as well as the interference and noise spectra were recorded at the point of measurement. (5 refs.)

New design for a flexible blood gas catheter and connecting cannula for use with a mass spectrometer .... See Entry 69039

87.60G Laser beams, microwaves, and other electromagnetic waves

(inc. NMR; for X-rays and gamma-rays, see 87.60J)

68991 Use of an ophthalmoscope for objective refraction of noncooperative patients. J.E.Richman, R.P.Garzia (Coll. of Optometry, Ferris State Coll., Big Rapids, MI, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.329-34 (April 1983).
Refractive ophthalmoscopy was performed on 16 subjects aged 5 to 27 years. Subjective refractions were performed on both eyes on the subjects followed by an ophthalmoscopic determination performed under cyloplegia by the authors. A 0.94 correlation was found between the subjectively determined 'dry' refractive error and the refractive error determined ophthalmoscopically under cycloplegia by both examiners. The results of the two procedures differed by 1D or less 82% of the time. The results indicate that refractive ophthalmoscopy is an alternative method for objectively determining refractive error in noncooperative patients with poor fixational stability. (14 refs.)

68992 Characteristics of a video-type pupillometer. K.M.Daum (Coll. of Optometry, Ohio State Univ., Columbus, OH, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.335-8 (April 1983).
In using a video-type pupillometer, the adjustment of the clipping level, the illumination of the target, the focus of the camera, and the viewing angle have been shown to affect the measurement. The focus of the camera and the viewing angle are the most important variables. The precision of this instrument can be as good as 0.01 mm. The accuracy of the instrument is good with regard to clinical standards: however, all measurements vary slightly from the known value. Interexaminer variation appears to be small. (3 refs.)

68993 On the measurement accuracy of the tissue permittivity in vivo. A.Kraszewski (Dept. of Electrical Engng., Univ. of Ottawa, Ottawa, Ontario, Canada), S.S.Stuchly, M.A.Stuchly, S.A.Symons.
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.37-42 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
An open-ended coaxial line sensor and a computer-controlled network analyzer have been extensively used for measuring the tissue permittivity in vivo at radio and microwave frequencies. An analysis is presented of measurement errors resulting from calibration and random errors of the network analyzer. The uncertainties in the system investigated are $\Delta\Gamma$=0.05 dB and $\Delta\phi$=0.3°. (11 refs.)

68994 Evaluation system for absolute brightness from the retinal vessels. C.Bosi, M.Neroni, P.Chistolini, R.Bedini (Lab. of Ingegneria Biomedica, Istituto Superiore di Sanita, Roma, Italy).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.291-4 (May 1983).
Describes a method for the absolute evaluation of the luminance of a photographic image of the fundus, based on a comparison between this image and a referred grey scale. The absolute measurements of the luminance of the particular on the film are performed by a microprocessor-controlled microfilm reader. This new method can be applied in general studies regarding the fundus of the eye in particular for studying retinal diseases caused by hypertension and diabetes. (6 refs.)

68995 An introduction to NMR imaging: from the Bloch equation to the imaging equation. W.S.Hinshaw, A.H.Lent (Technicare Corp., Solon, OH, USA).
Proc. IEEE (USA), vol.71, no.3, p.338-50 (March 1983).
The emerging technology of NMR imaging is introduced as a problem in system identification. The authors show how selected families of signals may be input into the system ('system,' in this case, is almost synonymous with 'patient') in order that the system's responses to these inputs may be directly interpreted in terms of the system parameters. Once identified, a raster display of the system parameters provides an internal image of the patient. Inputs to the system are four-component functions of time. One component decribes the strength of an RF signal, and the other three components govern the strength of three spatially varying, independently controlled magnetic fields (the gradient fields) in which the patient is immersed. In response to these inputs some of the protons in the patient, acting in concordance with the Bloch equation, give rise to local fluctuations in the magnetization which are detectd with a tuned antenna and a sensitive receiver. The relationship between this output signal and the system parameters is summarized in the imaging equation. (22 refs.)

Fiber-optic diaphragm-curvature pressure transducer .... See Entry 66398

Mathematical problems of computerized tomography .... See Entry 69044

87.60J Corpuscular radiation and radioisotopes

(inc. X-rays and gamma-rays)

68996 Signal processing in digital radiography. W.R.Brody (Stanford Univ., Stanford, CA, USA).
Trends & Perspect. Signal Process. (USA), vol.3, no.1, p.1-8 (March 1983).
Discusses the introduction of computerized axial tomography (CAT or CT) which in 1972 paved the way for widespread application of digital signal processing in medical X-ray imaging. The decreasing costs for digital processing and storage and the potential for increased speed and information density offered by digital technology will soon bring about the replacement of conventional film-based radiography with digital techniques. (no refs.)

68997 The computer increases the sharpness of X-ray diagnosis. G.Svahn.
Eltek. Aktuell Elektron. (Sweden), vol.26, no.6, p.16-18 (April 1983). In Swedish.
Describes the characteristics of X-ray film and the need to enhance both sharpness and contrast. Enhancement as introduced in the 'sixties using cine

or video systems is described. Digital radiography using a processor is explained. The author writes that such techniques give a great number of options in altering and diagnosing plates. Contrast enhancement is described in some detail. The author concludes with the view that the use of film will be entirely replaced by digital techniques in the next 5-10 years. (no refs.) *H.J.P.*

68998 Estimates of kidney volume by single photon emission tomography: a preliminary report. W.N.Tauxe (Div. of Nuclear Medicine, Univ. of Alabama Hospitals, Birmingham, AL, USA), A.Todd-Pokropek, F.Soussaline, C.Raynaud, C.Kellershohn.
Eur. J. Nucl. Med. (Germany), vol.8, no.2, p.72-4 (1983).
Algorithms for the estimation of organ volumes have been developed which may provide whole organ volumes and which may or may not, at the operator's choice, take into account any voids which may be contained within the organ. These algorithms have been applied to the estimation of the volume of the kidneys, in normal subjects and in patients with renal disease. The dimensions of the kidneys were similar to those derived from ultrasound study measurements which were performed independently. Kidney volume should prove especially useful in the diagnosis of early graft rejection and in the diagnosis of glomerulonephritis. (7 refs.)

68999 Fully automated sectorial equilibrium radionuclide ventriculography. Proposal of a method for routine use: exercise and follow-up. R.Standke, G.Hor, F.-D.Maul (Dept. of Radiology, J.W. Goethe-Univ., Frankfurt/Main, Germany).
Eur. J. Nucl. Med. (Germany), vol.8, no.2, p.77-83 (1983).
A fully automated computer program is described for processing equilibrium radionuclide ventriculography data with regard to gobal and sectorial left ventricular ejection fraction. The precise identification of the left ventricular outline, a prerequisite for reproducible determination of sectorial ejection fraction, was achieved by using morphological and functional criteria in a sequential edge detection technique. The high reproducibility of this method (correlation coefficient r: global ejection fraction $r=0.96$, sectorial ejection fraction $r=0.82=0.97$) allows the evaluation of a mean normal sectorial ejection fraction profile and its adaptation to the individual left ventricle. Computerized comparison between individual and adjusted normal sectorial ejection fraction permits quantitation of the degree of localization of functional impairment at rest, sectorial comparison between ejection fraction at rest and during peak exercise is used for the detection of ischemic functional impairment. The success rate of end diastolic left ventricular edge detection of 96% and the processing time of 150 s makes this method suitable for routine use. (25 refs.)

69000 Measurement of changes of blood flow in renal transplants. S.V.Ellam, M.N.Maisey, R.Mistry (Guy's Hospital, London, England).
Eur. J. Nucl. Med. (Germany), vol.8, no.2, p.84-6 (1983).
An accurate, reproducible method for calculating an index of renal blood flow from a dynamic ^{99m}Tc-labelled DTPA transplant study is described. The inter- and intra-variability of the method has been assessed. (3 refs.)

69001 Performance of neutron radiography systems using particle accelerators. J.A.Stokes, L.A.Parks, C.A.Preskitt, J.John (IRT Corp., San Diego, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1623-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The most crucial element of building a useful neutron radiography system is an intense source of neutrons. Among nuclear reactions employing accelerators, the ^{9}Be(d,n)^{10}B reaction is probably the best method for generating neutrons for radiography. This is due to its superior yield of neutrons that can be efficiently moderated and very low gamma-ray contamination. This has been demonstrated using a KN-4000 Van de Graaff accelerator coupled to an IRT Model ANR-100 moderator-collimator assembly, and excellent quality radiographs have been obtained. The Radio Frequency Quadrupole Linear Accelerator is found to be capable of providing an intense source of neutrons using the same reaction and is recommended for neutron radiography applications. (9 refs.)

69002 Element-sensitive computed tomography with fast neutrons. J.C.Overley (Phys. Dept., Univ. of Oregon, Eugene, OR, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1677-9 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The author demonstrates that energy-sensitive neutron transmission measurements can be used in conjunction with computed tomography to determine spatial distributions of specific elements in a sample containing elements of biological interest. A neutron continuum with energies up to 8.6 MeV is produced by ^{9}Be(d,n)^{10}B reactions in a thick target. The neutrons are collimated to a narrow beam and are used in a translate-rotate scan of the sample. Pulsed beam time-of-flight techniques are used to measure neutron transmission through the sample. Structure in the energy dependence of the transmission is used to determine the amounts of various attenuating elements encountered by the beam. These quantities are used in tomographic reconstructions of the sample. (5 refs.)

69003 Positron production and PET scanning. R.D.Hichwa (Cyclotron/PET Facility, Univ. of Michigan Medical School, Ann Arbor, MI, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1688-92 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A new program to study anatomical and physiological aspects of the brain that use positron emission tomographic (PET) techniques was instituted at the University of Michigan. A complete laboratory was constructed to facilitate the production of radiotracers, their incorporation into viable radiopharmaceuticals and the detection of their regional localization. The Cyclotron Corporation (TCC) CS-30 compact cyclotron is used to provide various short-lived $\beta+$nuclides. The TCC 4600A Neuro Positron Camera Tomograph is used to obtain transaxial images of the brain derived from the annihilation photons of the $\beta+$ tracers. The scanner resolution is 1.0 cm by 1.0 cm within the slice and 1.0 cm between slices. The tomograph is capable of simultaneously acquiring 5 slices in 5 seconds at the maximum spatial resolution. (15 refs.)

69004 Advanced medical accelerator design. J.R.Alonso, T.Elioff, A.Garren, R.A.Gough, H.A.Grunder, H.Lancaster, S.Magyary, V.More, R.Sah, J.Staples, R.Yourd (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1762-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
This report describes the design of an advanced medical facility dedicated to charged particle radiotherapy and other biomedical applications of relativistic heavy ions. Project status is reviewed and some technical aspects discussed. Clinical standards of reliability are regarded as essential features of this facility. Particular emphasis is therefore placed on the control system and on the use of technology which will maximize operational efficiency. The accelerator will produce a variety of heavy ion beams from helium to argon with intensities sufficient to provide delivered dose rates of several hundred rad/minute over large, uniform fields. The technical components consist of a linac injector with multiple PIG ion sources, a synchrotron and a versatile beam delivery system. An overview is given of both design philosophy and selected accelerator subsystems. Finally, a plan of the facility is described. (4 refs.)

69005 The neutron therapy facility at the University of Pennsylvania-Fox Chase Cancer Center. P.Bloch, R.Larsen, J.Chu (Dept. of Radiation Therapy, Univ. of Pennsylvania-Fox Chase Cancer Center Hospital School of Medicine, Philadelphia, PA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1788-92 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The fusion of deuterium and tritium nuclei results in the formation of a helium-4 nucleus and a 14 MeV neutron. This reaction readily takes place when deuterium and tritium ions are accelerated to potentials between 150-200 kV. These energy ions can be obtained in a moderate size accelerator. A DT neutron facility has been installed in the radiation therapy department of the University of Pennsylvania Hospital-Fox Chase Cancer Center. The system is being commissioned in a hospital setting to test the efficacy of fast neutron radiotherapy. (15 refs.)

69006 Heavy ion radiotherapy at the Lawrence Berkeley Laboratory. G.T.Y.Chen, J.R.Castro, J.M.Collier, W.M.Saunders (Biology & Medicine Div., Lawrence Berkeley Lab., Berkeley, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1813-15 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, ~~8-10~~ Nov. 1982).
Heavy ion radiotherapy potentially offers both dose localization and biologic advantages over conventional radiations in the treatment of cancer. Approximately 400 patients have been treated with either helium, carbon, neon, argon or silicon beams. Aspects of particle therapy are reviewed. Experience with these beams have defined parameters required of a hospital based heavy ion machine. A design study of such a machine is now underway at LBL. (10 refs.)

69007 Liquid scintillation counting—perils and pitfalls.
Lab. Equip. Dig. (GB), vol.21, no.4, p.81-5 (April 1983).
Liquid scintillation counting is an extremely sensitive analytical technique for detecting and measuring radioactive decay, especially of the low energy beta emitters such as phosphorus-32, tritium and carbon-14. It is widely used in a variety of biomedical applications including research work in biochemistry and molecular biology, pharmaceutical research and quality control, and clinical investigations as well as environmental monitoring of radioactivity. However, for valid interpretation of experimental data, an understanding of the physical process, the instrumental operation of the LS counter and the techniques of sample preparation is vital. The aim of the article is to give a general overview. (no refs.)

69008 Image quality evaluation of a digital fluorographic imaging device. Pei-Jan Paul Lin, R.A.Mintzer, H.L.Neiman (Dept. of Radiology, Northwestern Univ. Medical School, Chicago, IL, USA).
Opt. Eng. (USA), vol.22, no.2, p.256-9 (March-April 1983).
A low contrast phantom designed specifically for the evaluation of the image quality obtained from a digital fluorographic imaging device (DFID) is described. The design rationale and the image quality evaluation procedure utilizing the phantom are discussed along with the test results. (3 refs.)

69009 Applications of computerized tomography to diagnostic radiology. L.Axel, P.H.Arger, R.A.Zimmerman (Dept. of Radiology, Hospital of the Univ. of Pennsylvania, Philadelphia, PA, USA).
Proc. IEEE (USA), vol.71, no.3, p.293-7 (March 1983).
Computerized tomography (CT) has revolutionized the practice of diagnostic radiology. The combination of greatly improved ability to distinguish between regions of similar X-ray absorption and the ability to separate overlying regions from each other has made possible the radiographic demonstration of many organs and disease processes that previously could be, at best, poorly demonstrated. CT of the brain has greatly decreased the need for the dangerous and uncomfortable procedures that were previously required to image the brain. It has also improved imaging capabilities in many other areas of the body, and thus decreased the need for other, more dangerous, imaging techniques. The authors briefly discuss how CT has extended conventional diagnostic radiology and present some examples of its usefulness in neurological and other diseases. (11 refs.)

69010 Cardiac computed tomography. D.P.Boyd, M.J.Lipton (Dept. of Radiology, School of Medicine, Univ. of California, San Francisco, CA, USA).
Proc. IEEE (USA), vol.71, no.3, p.298-307 (March 1983).
Diseases of the heart and blood vessels represent one of the most challenging problems for advanced diagnostic imaging systems. Not only do these diseases represent the major medical problem to our time in terms of death, acute and chronic illness, and disability, but cardiac diagnosis involves complex technical difficulties due to rapid motion and the complex structure of the heart and cardiovascular system. Computerized-tomographic scanning is potentially an ideal cardiac imaging modality since CT is a cross-sectional imaging method with potentially very high resolution. Currently available CT scanners have exposure speeds in the range of 1-5 s, a speed that is inadequate for the majority of cardiovascular imaging applications. Nevertheless, a variety of limited CT scanning techniques have been successfully applied to selected imaging problems. These methods involve the use of contrast media injected into the blood combined with either dynamic CT scanning or gated CT scanning. The authors describe the CVCT scanner, under development at the University of California, San Francisco, which will image up to 8 contiguous slices at a rate of 36-54 images per second. The technical feasibility of the CVCT has been demonstrated using a testbed simulation of the scanning-beam configuration. The completed prototype scanner is expected to be available for testing early in 1983. (54 refs.)

69011 High-speed three-dimensional X-ray computed tomography: the dynamic spatial reconstructor. R.A.Robb, E.A.Hoffman, L.J.Sinak, L.D.Harris, E.L.Ritman (Dept. of Physiology & Biophys., Mayo Clinic, Rochester, MN, USA).
Proc. IEEE (USA), vol.71, no.3, p.308-19 (March 1983).
Most X-ray CT scanners require a few seconds to produce a single two-dimensional (2-D) image of a cross section of the body. The accuracy of full three-dimensional (3-D) images of the body synthesized from a contiguous set of 2-D images produced by sequential CT scanning of adjacent body slices is limited by (1) slice-to-slice registration (positioning of patient); (2) slice thickness; and (3) motion, both voluntary and involuntary, which occurs during the total time required to scan all slices. Therefore, this method is inadequate for true dynamic 3-D imaging of moving organs like the heart, lungs and circulation. To circumvent these problems, the dynamic spatial recon-

structor (DSR) was designed by the Biodynamics Research Unit at the Mayo Clinic to provide synchronous volume imaging, that is stop-action (1/100 s), high-repetition rate (up to 60/s), simultaneous scanning of many parallel thin cross sections (up to 240, each 0.45 mm thick, 0.9 mm apart) spanning the entire anatomic extent of the bodily organ(s) of interest. These capabilities are achieved by using multiple X-ray sources and multiple 2-D fluoroscopic video camera assemblies on a continually rotating gantry. (39 refs.)

69012 Single-photon emission computed tomography. G.F.Knoll (Dept. of Nuclear Engng., Univ. of Michigan, Ann Arbor, MI, USA).
Proc. IEEE (USA), vol.71, no.3, p.320-9 (March 1983).
The subject of single-photon emission computed tomography (SPECT) is generally reviewed. The basic interaction processes of gamma rays in matter are outlined, and the formation of conventional gamma-ray images is described. The extension of these concepts to the formation of three-dimensional or tomographic images is outlined. Of particular concern in emission tomography, the effects of gamma-ray attenuation and scattering are outlined. Several examples are given of practical SPECT systems, and representative results are given. (23 refs.)

69013 Application of computerized tomography to radiation therapy and surgical planning. P.Bloch (Dept. of Radiation Therapy, Hospital of the Univ. of Pennsylvania, Philadelphia, PA, USA), J.K.Udupa.
Proc. IEEE (USA), vol.71, no.3, p.351-5 (March 1983).
Computerized tomography (CT) which permits imaging the internal anatomy in axial cross section, has had a major impact in medicine, primarily in the diagnostic area. The CT scans are also useful in determining the extent of disease which is important in selecting the appropriate therapy. For therapy, the CT scan is becoming important in planning a course of radiation therapy for a cancer patient and to a lesser extent, in planning a surgical reconstruction for some patients. For both of these treatment modalities it would be desirable to have a three-dimensional reconstruction of the internal anatomy. This paper discusses the use of a three-dimensional perspective of the internal anatomy, obtained from multiple CT scans, as a guide to these two therapeutic modalities. (17 refs.)

69014 Overview of computerized tomography with emphasis on future developments. R.H.T.Bates, K.L.Garden (Dept. of Electrical Engng., Univ. of Canterbury, Christchurch, New Zealand), T.H.Peters.
Proc. IEEE (USA), vol.71, no.3, p.356-72 (March 1983).
The applications of computer-assisted, or comput(eriz)ed, tomography (CT) are reviewed. The major emphasis is on medical applications, but all relevant technical sciences are covered. A unified descriptive account of the underlying principles is presented (detailed reviews of algorithms and their mathematical backgrounds can be found elsewhere in this special issue). Deficiencies in existing hardware and software are identified and the possible means of remedying the more urgent of these are outlined. Promising approaches for future research and development into CT are suggested. (166 refs.)

69015 Physical problems of computerized tomography. A.Macovski (Dept. of Electrical Engng., Stanford Univ., Stanford, CA, USA).
Proc. IEEE (USA), vol.71, no.3, p.373-8 (March 1983).
A cross-sectional image of an object can be accurately reconstructed if its projections or line integrals are known at all angles. This fundamental and exciting property has been applied to a variety of applications, primarily in the area of medical imaging. In many cases, however, the physical measurements fail to accurately define the complete set of line integrals. This leads to inaccuracies and distortions in the resultant reconstruction. The physical measurements can be inadequate in a number of ways. These include nonlinearities, noise, and insufficient data. The nonlinearities can arise from a nonlinear detector process, or the inability to accurately extract the information in the exponent by taking logs. The noise can be the usual statistical uncertainty of the measurement or an interfering component such as scatter. The data can be insufficient in a number of ways including inadequate sampling or regions of missing data. Also, the measurements of a source distribution can be distorted by an unknown attention distribution, resulting in errors in the reconstruction. (34 refs.)

69016 Reconstruction algorithms: transform methods. R.M.Lewitt (Dept. of Radiology, Hospital of the Univ. of Pennsylvania, Philadelphia, PA, USA).
Proc. IEEE (USA), vol.71, no.3, p.390-408 (March 1983).
Transform methods of image reconstruction from projections are based on analytic inversion formulas. In this tutorial paper, the inversion formula for the case of two-dimensional (2-D) reconstruction from line integrals is manipulated into a number of different forms, each of which may be discretized to obtain different algorithms for reconstruction from sampled data. For the convolution-backprojection algorithm and the direct Fourier algorithm the emphasis is placed on understanding the relationship between the discrete operations specified by the algorithm and the functional operations expressed by the inversion formula. The performance of the Fourier algorithm may be improved, with negligible extra computation, by interleaving two polar sampling grids in Fourier space. The convolution-backprojection formulas are adapted for the fan-beam geometry, and other reconstruction methods are summarized, including the rho-filtered layergram method, and methods involving expansions in angular harmonics. A standard mathematical process leads to a known formula for iterative reconstruction from projections at a finite number of angles. A new iterative reconstruction algorithm is obtained from this formula by introducing one-dimensional (1-D) and 2-D interpolating functions, applied to sampled projections and images, respectively. (102 refs.)

69017 Finite series-expansion reconstruction methods. Y.Censor (Hospital of the Univ. of Pennsylvania, Philadelphia, PA, USA).
Proc. IEEE (USA), vol.71, no.3, p.409-19 (March 1983).
Series-expansion reconstruction methods made their first appearance in the scientific literature and in the CT scanner industry around 1970. Great research efforts have gone into them since but many questions still wait to be answered. These methods, synonymously known as algebraic methods, iterative algorithms, or optimization theory techniques, are based on the discretization of the image domain prior to any mathematical analysis and thus are rooted in a completely different branch of mathematics than the transform methods which are discussed in this issue by Lewitt (see ibid., vol.71, no.3, p.390-408, 1983). How is the model set up? What is the methodology of the approach? Where does mathematical optimization theory enter? What do these reconstruction algorithms look like? How are quadratic optimization, entropy optimization, and Bayesian analysis used in image reconstruction? Finally, why study series expansion methods if transform methods are so much faster? These are some of the questions that are answered in this paper. (71 refs.)

69018 Wiener spectral effects of spatial correlation between the sites of characteristic X-ray emission and reabsorption in radiographic screen-film systems. C.E.Metz, C.J.Vyborny (Dept. of Radiology, Univ. of Chicago, Chicago, IL, USA).
Phys. Med. & Biol. (GB), vol.28, no.5, p.547-64 (May 1983).
When characteristic X-rays are generated and reabsorbed in the phosphor of a radiographic screen-film system, the positions at which light is emitted from the initial and secondary interactions are correlated. A simple statistical model is developed to account for the effect of this correlation on the Wiener spectrum of quantum mottle. Unlike previous models, which ignore spatial correlation, the new model predicts that not only noise magnitude but also noise texture is changed as the incident X-ray energy exceeds the phosphor K-edge. (18 refs.)

69019 Energy and angular dependence of X-ray absorption and its effect on radiographic response in screen-film systems. Heang-Ping Chan, Kunio Doi (Dept. of Radiology, Univ. of Chicago, Chicago, IL, USA).
Phys. Med. & Biol. (GB), vol.28, no.5, p.565-79 (May 1983).
The relationship between the film density and the X-ray energy absorbed in the screens, and the effect of the components of a screen-film system on X-ray absorption in the screen phosphor has been studied. It is concluded that, to a good approximation, the total absorbed X-ray energy can be calculated ignoring components other than the phosphor, and that the absorbed energy is related to the film density through the characteristic curve of the film. This simple relationship provides a basis for the theoretical prediction of the radiographic performance of an imaging system. Analytical expressions have been derived for the energy absorbed in model screens, containing one or two high-atomic-number elements. For incident energies above the K-edge of the high-Z elements, the contribution of the K X-rays to energy absorption was included by the use of a K-reabsorption factor. This factor was determined for eight screen pairs as a function of incident photon energy and incident angle. (20 refs.)

69020 A comparison of rotating slant hole collimator and rotating camera for single photon emission tomography of the heart. M.J.Myers (Dept. of Medical Phys., Hammersmith Hospital, London, England), E.B.Sokole, J.de Bakker.
Phys. Med. & Biol. (GB), vol.28, no.5, p.581-8 (May 1983).
Measurements were made on the tomographic imaging abilities of a rotating slant hole collimator and a rotating scintillation camera system using a standard heart phantom and thallium-201. This allowed a comparison to be made between these and published results for conventional imaging and the seven pinhole technique under standardised conditions. Although better intraplanar resolutions were obtained with the rotating slant hole, the rotating camera was found to give superior definition of a defect and less propagation between reconstructed sections of the phantom. (9 refs.)

JSW's BABY CYCLOTRON ....See Entry 65729

Spatial resolution in industrial tomography ....See Entry 68705

Radiochemical neutron activation analysis method for the determination of chromium, cobalt and nickel in tissue samples .... See Entry 68841

A lyoluminescent tissue-equivalent dosemeter for pion therapy beams ....See Entry 69026

Dosimetry with tissue-equivalent ionisation chambers in fast neutron fields for biomedical applications .... See Entry 69027

Mathematical problems of computerized tomography ....See Entry 69044

Display of 3D information in discrete 3D scenes produced by computerized tomography ....See Entry 69045

A medical cyclotron, facilities and program at the King Faisal Specialist Hospital and Research Centre Riyadh, Saudi Arabia ....See Entry 69050

Application of low energy proton beam for determination of elemental composition in healthy and pathological tissues ....See Entry 69068

PIXE using cyclotron and lung cancer pathogenesis ....See Entry 69069

PIXE analysis of human hair samples .... See Entry 69070

Application of PIXE analysis to neurological diseases ....See Entry 69071

A comparison of PIXE and flame atomic spectrometry for hair analysis ....See Entry 69072

Ion beam analysis of scalp hair as a monitor of occupational exposure ....See Entry 69073

87.60L Preparation of radioactive materials for medical and biomedical uses

69021 The production of spallation radionuclides for medical applications at BLIP. L.F.Mausner, P.Richards (Medical Dept., Brookhaven Nat. Lab., Upton, NY, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1793-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The Brookhaven LINAC isotope producer (BLIP) is the first facility to demonstrate the capability of a large linear accelerator for efficient and economical production of difficult-to-make, medically useful radionuclides. It utilizes the excess beam capacity of a LINAC that injects 200 MeV protons into the 33 GeV Alternating Gradient Synchrotron. The linac provides an integrated beam current of 60 μA for radionuclide production. The basic target types are encapsulated salt pellets, gases, and metallic foils. The medically important isotopes ^{123}I, ^{81m}Kr, ^{52}Fe, and ^{127}Xe are routinely produced. These and other potentially important radionuclides can result in improved diagnostic and therapeutic procedures in nuclear medicine with reduced patient dose, and lead to a better understanding of physiological processes in health and disease. (2 refs.)

69022 Cyclotron production of no-carrier-added medical radionuclides. M.C.Lagunas-Solar (Crocker Nuclear Lab., Univ. of California, Davis, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1805-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Charged-particle accelerators, particularly cyclotrons, are presently the source of the majority of the radionuclides used for the synthesis of radioactive drugs. These drugs are then used in clinical research and in diagnostic nuclear medicine. The physical properties of the accelerator-made radionuclides, the chemical characteristics of their drug formulations, and their biological properties are significant factors affecting the radioactive drug's quality and effectiveness in the diagnostic procedure. Because of their ultimate application in nuclear medicine, both cyclotron and radiochemical methods used in their production, purification, and formulation must be suited to render a radioactive drug of the highest purity, in terms of radionuclidic, radiochemical, chemical, and biological quality. (19 refs.)

69023 I-123 labeled radiotracers in cardiovascular nuclear medicine. P.V.Kulkarni (Dept. of Radiology, Univ. of Texas Health Sci. Center, Dallas, TX, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1809-12 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

Radiohalogens produced in a cyclotron are nuclides of choice for radiopharmaceuticals. I-123 labeled substrates suitable for imaging the myocardium include receptor binding agents, muscarinic antagonists and analogs of fatty acids. Radioiodinated (I-123) fatty acid analogs have gained significant attention because of the possibility that these might give quantiative information regarding the regional myocardial metabolic activity by noninvasive scintigraphic methods. Incorporation of tellurium hetero into a carbon skeleton or beta methylation of a long chain phenyl fatty acid tends to prolong the retention of radioactivity in the myocardium of experimental animals. It is recognized that the radioiodine needs to be placed on a phenyl ring attached (in the ω-position) to a long chain fatty acid for the invivo stability of the C-I-bond. Among the methods of radioiodination of ω-phenyl fatty acids, a method developed in the author's laboratory using an organo-thallium intermediate has been found to be simple, efficient, reproducible, and suitable for routine application. (25 refs.)

69024 Status and prospects of the production of radioisotope-tagged compounds in the USSR. E.I.Mikerin.

Sov. At. Energy (USA), vol.53, no.2, p.544-5 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.89-91 (Aug. 1982). [received: April 1983]

The author reviews the range of available radioisotope-tagged compounds and their production in the USSR. The isotopes discussed include ^{14}C, ^{3}H, and ^{32}P. (no refs.)

Positron production and PET scanning ....See Entry 69003

Installation and testing of a hospital based cyclotron for radiation therapy and isotope production ....See Entry 69049

A medical cyclotron, facilities and program at the King Faisal Specialist Hospital and Research Centre Riyadh, Saudi Arabia ....See Entry 69050

87.60M Radiation dosimetry

69025 Mammalian spermatogenesis as a new system for biologic dosimetry of ionizing irradiation. U.Hacker, J.Schumann, W.Gohde (Dept. of Experimental Tumor Res., Hornheide Clinic, Univ. of Munster, Munster, Germany).

Acta Radiol. Oncol. Radiat. Therapy Phys. & Biol. (Sweden), vol.21, no.5, p.349-51 (1982).

The radiation induced reduction of the number of DNA synthesizing cells (spermatogonia) is described using the fast-working flow cytophotometer. Since there is no shoulder in the initial part of the dose response curve this model of biologic dosimetry is very sensitive. The D_{50} value is 0.25 Gy; a radiation exposure of only 0.1 Gy can be detected. (17 refs.)

69026 A lyoluminescent tissue-equivalent dosemeter for pion therapy beams. N.A.Atari, S.R.Malik (Dept. of Phys., Kuwait Univ., Safat, Kuwait), D.J.Brenner, R.Hilko, J.N.Bradbury.

Phys. Med. & Biol. (GB), vol.28, no.5, p.493-502 (May 1983).

The light emitted when pion irradiated glucose is dissolved in luminol solution has been found to be proportional to the pion beam depth dose distribution in water as determined by a TE ionisation chamber. The lyoluminescence of glucose overlaps very closely with the response profile of the ionisation chamber to the 170 MeV/c π^- mesons giving a Bragg peak to plateau ratio of 3:1. In comparison, the thermoluminescence response of LiF (TLD-700) to pions has been found to be deviate significantly from this ratio. The close tissue equivalence of glucose, non-toxicity and its excellent lyoluminescent retention properties are important advantages over currently used dosemeters in clinical pion therapy, especially when direct in vivo measurements are considered. Pion doses ranging between 0.5 Gy (50 rad) and 30 Gh (3000 rad) were measured with an accuracy ±5% and reproducibility 3-5%. (24 refs.)

69027 Dosimetry with tissue-equivalent ionisation chambers in fast neutron fields for biomedical applications. J.Zoetelief, J.J.Broerse (Radiobiological Inst., Rijswijk, Netherlands).

Phys. Med. & Biol. (GB), vol.28, no.5, p.503-20 (May 1983).

The use of calibrated issue-equivalent (TE) ionisation chambers is commonly considered to be the most practical method for total absorbed dose determinations in mixed neutron-photon fields for biomedical applications. The total absorbed dose can be derived from the charge produced within the cavity of an ionisation chamber employing a number of physical parameters. To arrive at the charge produced in the cavity several correction factors have to be introduced which are related to the operational characteristics of the chambers. Information on the operational characteristics of four TE ionisation chambers is presented in relation to the ion collection, density and composition of gas in the cavity, wall thickness and effective point of measurement. In addition, some recent results from an ionisation chamber operated at high gas pressures (up to 8 MPa(80 bar)) are presented. The total chamber operated at high gas pressures (up to 8 MPa(80 bar)) are presented. The total absorbed doses derived from TE ionisation chambers show agreement within the uncertainty limits with results from other independent dosimetry methods, i.e., differential fluence measurements and a TE calorimeter. Conscientious experimentation and a common data base can provide dosimetry results with TE ionisation chambers with variations of less than ±2%. (40 refs.)

69028 A theoretical concept for measuring doses from external radiation sources in radiation protection. B.R.L.Siebert, R.Hollnagel, R.Jahr (Phys. Tech. Bundesanstalt, Braunschweig, Germany).

Phys. Med. & Biol. (GB), vol.28, no.5, p.521-33 (May 1983).

A physically consistent concept is presented for monitoring individual exposures from external radiation, giving quantitative relations between dosemeter readings, doses in an arbitrary phantom (receptor doses) and receptor-free radiation field quantities. As a consequence, the aim of the design for the construction of dosemeters consisting of one or several detectors can be formulated mathematically. A distinction is made between 'fitted' dosemeters satisfying this relation, and 'non-fitted' dosemeters which do not. The calibration of both types is discussed in detail. For non-fitted dosemeters, procedures to determine the error limits are given. The application to accident dosimetry is briefly discussed. (14 refs.)

69029 Experience from application of radiolyoluminescence and electron paramagnetic resonance to dosimetry of accidental irradiation. I.A.Alekhin, S.P.Babenko, S.N.Kraitor, K.K.Kushnereva, A.V.Barabanova, S.R.Ginzburg, R.D.Drutman, V.N.Petushkov.

Sov. At. Energy (USA), vol.53, no.2, p.546-50 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.91-5 (Aug. 1982). [received: April 1983]

It was proposed that the dose from accidental irradiation be measured by using radiolyoluminescence (RLL), i.e. the luminescence which occurs during the dissolution of samples of human biological tissue (hair, nails), clothing, documents, and other objects which accompany a person under the conditions of an accident. Radiolyoluminescence is caused by free radicals which are formed when organic substances are irradiated, which can be detected by the method of electron paramagnetic resonance (EPR). The authors made a comparative study of the EPR and RLL of human hair, cotton fabric used to make protective clothing for the personnel of sections with an accident hazard, as well as synthetic and woollen fabrics used in everyday clothing. They investigated the characteristics of RLL and EPR which are of interest for dosimetry of accidental irradiation. For the first time, RLL and EPR have been used to measure the dose of accidental irradiation of accelerator personnel. (3 refs.)

Nuclear waste disposal: the interface between performance assessment and research ....See Entry 65408

Liquid ionization chamber for absorbed dose determinations in photon and electron beams ....See Entry 65683

Fricke dosimetry in low dose range for food irradiation ....See Entry 65690

The effect of radiation on bioluminescent bacteria: possible use of luminescent bacteria as a biological dosemeter ....See Entry 68985

Measurement of daylight UVA in Glasgow ....See Entry 69303

87.60P Radiation protection

(inc. radiation monitoring)

69030 Selectively absorbing glasses for the potential prevention of ocular disorders. G.K.Megla (Corning Glass gmbH, Wiesbaden, germany).

Appl. Opt. (USA), vol.22, no.8, p.1216-20 (15 April 1983).

Photochromic eyewear is described which selectively blocks the blue and near-ultraviolet portion of the spectrum. The possible advantages of this wavelength-selective protective eyewear are discussed in terms of its applications to certain ocular pathologies such as retinitis pigmentosa to preserve normal vision longer, and to reduce the visual impairment in lensless eyes following cataract removal. (25 refs.)

Radiological safety of accelerators. A comparison of performance standards ....See Entry 65684

Radiation protection considerations of ion implantation systems ....See Entry 65686

Standards for use of visible and nonvisible radiation on the eye ....See Entry 68980

A theoretical concept for measuring doses from external radiation sources in radiation protection ....See Entry 69028

87.70 BIOMEDICAL ENGINEERING

69031 Inadequate dynamic response of catheter-transducer systems, a source of error in direct blood pressure measurement. W.Schilt (Univ. Bern, Bern, Switzerland).

Biomed. Tech. (Germany), vol.28, no.5, p.112-17 (May 1983). In German.

The dynamic response of a catheter-transducer system for direct measurement of blood pressure, currently used in intensive care units, has been evaluated. Simulated pressure signals of the aortic and pulmonary artery type revealed an undamped frequency of 5.17 cps, and a damping factor of 0.25 s. Measurements of absolute values of systolic pressure were too high by 22% and 27% for the aortic and pulmonary signal, respectively. Corresponding diastolic values were too high by 4% and 18%, respectively. The phase lag for both signal types approached 4-5% of the pulse duration. Quantitative errors of pressure measurement at the bedside must be expected if current catheter-transducer systems with long connection lines are not specifically adapted for dynamic response. (11 refs.)

69032 Brain function monitoring: a new method for simultaneous recording and processing of EEG-power spectra and brainstem potentials (BAEP). H.Maresch, G.Pfurtscheller, S.Schuy (Inst. fur Elektro- und Biomedizinische Tech., Tech. Univ. Graz, Graz, Austria).

Biomed. Tech. (Germany), vol.28, no.5, p.117-22 (May 1983).

Brainstem auditory evoked potentials (BAEP) and compressed EEG spectra are both valuable tools for brain function monitoring. The simultaneous recording and online evaluation of both signals from the same derivations was established on a microcomputer system, permitting a continuous observation of the patient. The filtering of the brainstem potentials was done by online computation of digital filters in the frequency domain. First applications to healthy subjects and patients during carotid endarterectomy under hyperbaric conditions were performed. (8 refs.)

69033 A PDP-11 assembly language program for digitizing, sorting, and averaging evoked brain potentials. A.L.Schmidt (Div. of Neurosurgery, Univ. of Texas Medical Branch, Galveston, TX, USA).

Behav. Res. Methods & Instrum. (USA), vol.15, no.1, p.85-6 (Feb. 1983).

Describes a computer program to average single-trial evoked brain potentials (EPs) and perform later data manipulation and analysis. The program is an advance on previous methods because it eliminates the need to process data more than once. It uses the MACRO-11 assembly language on a DEC PDP-11. The operations carried out are digitizing, sorting and averaging. (6 refs.)

69034 Design and status of a specialized cyclotron for positron tomography. R.R.Highfill (Orbit Inc., Oak Ridge, TN, USA).

IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1765-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).

A specialized, small cyclotron has been developed for the sole objective of producing the principle isotopes used in positron tomography. The following features make it advantageous for clinical applications: 1) It is capable of producing high activity levels of the proper precursor chemical forms: 2) It is much smaller than other cyclotrons, having only slightly more than half the energy of the next smallest model in general use; 3) It is automated to operate under microprocessor control; 4) Its vertical beam plane design permits the external targetry to be recessed into the floor to minimize the amount of bulky neutron shielding material that must be added to the room; 5) It is a single particle accelerator, which simplifies the design and reduces the operational requirements; and 6) The translation of the cyclotron to various target positrons permits the targetry with its many plumbing, gas transfer and electrical connections to remain stationary. (8 refs.)

69035 Therac 25: a new medical accelerator concept. T.Taylor, G.Van-Dyk (AECL, Kanata, Ontario, Canada), L.W.Funk, R.M.Hutcheon, S.O.Schriber.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1768-71 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
An electron linear accelerator system with several novel features has been developed for radiation therapy. The beam from a 25 cell S-band standing wave structure, operated in the $\pi/2$ mode with on-axis couplers is reflected in an achromatic isochronous magnet and reinjected into the accelerator. The second pass doubles the energy while conserving RF power and minimizing the overall length of the unit. The beam is then transported through an annular electron gun and bent into the collimator by an innovative two-element doubly achromatic doubly focusing 270° magnet which allows a significant reduction in unit height. The energy is reduced by adjusting the position of the reflecting magnet with respect to the accelerator. The system generates 5 Gy m^2 min^{-1} beams of 25 MV photons and 5 to 25 MeV electrons. Extensive use of tungsten shielding minimizes neutron leakage. The photon mode surface dose is reduced by a carefully optimized electron filter. An improved scanning system gives exceptionally low electron-mode photon contamination. (7 refs.)

69036 A simple method of measuring the footsole pressure of normal subjects using Prescale pressure-detecting sheets. H.Aritomi, M.Morita, K.Yonemoto (Kitasato Univ. School of Medicine, Sagamihara, Japan).
J. Biomech. (GB), vol.16, no.2, p.157-65 (1983).
A simple method of measuring the pressure beneath the footsole was described using 'Prescale' pressure detecting sheets. These are two sheets, one coated with microcapsules which contain a color producing agent, and the other coated with a color-developing agent. As the applied pressure determines the amount of microcapsules that rupture, the coloring sheet reveals its density corresponding to the pressure applied. At the application of this method, normal subjects were studied quantitatively on distribution of the pressure beneath the footsole. The results were compared with the structure of the foot as revealed by X-ray examination in order to study the correlation between the two. The clinical benefits and indication of this method were discussed. (8 refs.)

69037 Artefact encountered by the vibration detection system. R.A.B.Mollan, G.W.Kernohan, P.H.Watters (Dept. of Orthopaedic Surgery, Queen's Univ. of Belfast, Belfast, N Ireland).
J. Biomech. (GB), vol.16, no.3, p.193-9 (1983).
The use of piezo-electric accelerometers to detect sounds and vibrations emitted from joints and tissues is a significant advance on acoustic detection systems. All possible sources of artefact signal encountered by the vibration emission technique were investigated. A number of errors could be avoided by good technique. All artefact signals were easily distinguished from true vibration emission. As the accelerometer cables were part of the capacitance system it was concluded that other types of accelerometer should be investigated to reduce cable noise. (5 refs.)

69038 Digital filtering and regression algorithms for an accurate detection of the baseline in ECG signals. F.Bartoli, S.Cerutti, E.Gatti (Dept. of Electronics, Polytech. of Milan, Milano, Italy).
Med. Inf. (GB), vol.8, no.2, p.71-82 (April-June 1983).
A method of analogue and digital filtering is used to diminish the presence of high-frequency noise, while algorithms of linear and nonlinear regression are used to fit the slow drift of the baseline and the low-frequency associated noise. The algorithms are implemented in an experimental program applied to a series of 100 patients whose orthogonal leads (Frank leads) have been recorded at the Cardiopulmonary Physiology Department in the Ospedale Maggiore Ca' Granda in Milan. (18 refs.)

69039 New design for a flexible blood gas catheter and connecting cannula for use with a mass spectrometer. D.T.Delpy (Dept. of Medical Phys. & Bioengng., Univ. Coll. London, London, England).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.259-63 (May 1983).
A design for the manufacture of a flexible blood gas catheter and connecting cannula for use with a mass spectrometer is outlined. The design minimises gas diffusion through the wall of the catheter or cannula by enclosing it in another flexible plastic tube. The annular space between the concentrically arranged tubes is evacuated, thus preventing gas diffusing through the outer tube wall from reaching the inner tubing. Results are presented showing that with this configuration the wall diffusion signal can be reduced to a level similar to that obtained with metal walled catheters and cannulae. (3 refs.)

69040 Microprocessor-based system for the measurement and analysis of an expiratory flow-volume curve. A.H.G.El-Dhaher, H.A.Kaouri (Dept. of Phys., Faculty of Sci., Kuwait Univ., Kuwait), K.Y.Mustafa.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.277-84 (May 1983).
Analogue recording and plotting on an xy plotter of flow-time signals tend to produce inaccurate analysis of respiratory data. To improve on the accuracy of the measurement and reduce the time required for such an analysis a microprocessor-based system has been developed. The system is designed to be easily operated and requires minimum time from the user. It gives the operator an indication of the drift in the transducer based on calibration at a standard flow rate. The system is interactive with the user via a visual display terminal. It offers the user full freedom in selecting the parameters to be measured. The displayed results are calculated from the measured signal and compared with predicted values. Hard copy of the displayed information can be produced upon user command. The software is flexibly designed to allow for any modification or future expansion. (9 refs.)

69041 Monitoring bruxism. P.Stock (Dept. of Electrical Engng., Univ. of Adelaide, Adelaide, Australia), N.G.Clarke.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.295-300 (May 1983).
The parafunctional activity of bruxism is believed to be commonly practised by a high proportion of the population. A technique is described for the amplification of e.m.g. signals resulting from the clenching of masticatory muscles. The analogue voltages produced within the muscles are converted to digital form and processed within a microcomputer for subsequent printout from a teletypewriter. The hardware and software used to obtain bruxing data is described. (3 refs.)

69042 The 'Hollywood gaitrack': a method for measuring temporal and distance factors of gait. M.Knight, S.Nade, W.Ongley (Repatriation General Hospital, Hollywood, Australia).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.306-10 (May 1983).
The Hollywood gaitrack is an inexpensive, portable and accurate system for recording some aspects of how a person walks. The system uses a low-cost microcomputer and provides the results at the time of the test. The system is simple to use, and presents the data in an easily interpreted form. The authors are currently using the system for collection of the time and distance parameters of people recovering from surgery for arthritic hips and knees to characterise the normal patterns of recovery after such forms of treatment. (4 refs.)

69043 Turning points spectral analysis of the interference myoelectric activity. P.J.A.Lago (Grupo de Matematica Aplicada, Univ. do Porto, Porto, Portugal), N.B.Jones.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.333-42 (May 1983).
A new method of computer analysis of the interference myoelectric activity is presented. The technique focuses on the time sequence of turning points of the e.m.g. Preliminary analysis shows that biphasic potentials produce a normalised spectral density of the e.m.g. turning points which is very close to 1.0 except for the low frequencies, whereas the occurrence of polyphasic action potentials is reflected by significant deviations from 1.0 for a wide range of frequencies. Experimental results obtained under sustained voluntary contraction in the human brachii biceps are presented. The observed alterations of the e.m.g. turning points spectral density were found to be in agreement with other independent reports which point to an increase of the number of polyphasic potentials in the e.m.g. with increasing contraction time. It is concluded that e.m.g. turning points spectral analysis is sufficiently selective and that it looks to be a sensible technique for the detection and quantification of the incidence of polyphasic potentials in the interference myoelectric activity. (27 refs.)

JSW's BABY CYCLOTRON .... See Entry 65729

Fiber-optic diaphragm-curvature pressure transducer .... See Entry 66398

Description and application of an ultrasonic Doppler velocimeter for the small vessels .... See Entry 68988

Use of an ophthalmoscope for objective refraction of noncooperative patients .... See Entry 68991

Characteristics of a video-type pupillometer .... See Entry 68992

The production of spallation radionuclides for medical applications at BLIP .... See Entry 69021

87.70E Diagnostic methods and instrumentation

(see also 87.60 Medical and biomedical uses of fields, radiations and radioactivity)

69044 Mathematical problems of computerized tomography. A.K.Louis, F.Natterer (Inst. fur Numerische und Instrumentelle Math., Univ. Munster, Munster, Germany).
Proc. IEEE (USA), vol.71, no.3, p.379-89 (March 1983).
The data measured in computerized tomography; e.g., the X-ray attenuation in X-ray tomography or the resonance phenomena in nuclear magnetic resonance tomography, have to be processed to produce the pictures on which the diagnostic evaluation of the physician is based. This process consists of the solution of the following mathematical problem. The data depend on the searched-for distribution and this dependence can be described as an integral transform. To produce the final picture amounts to the inversion of the integral transform. This paper is concerned with the description of the integral transforms modeling the different techniques in computerized tomography. Among other things, the following questions are treated. Which numerical problems does one have to encounter in inverting the transforms; e.g., what accuracy in the reconstruction can one expect in dependence on the accuracy of the data. To what extent is a distribution determined by a finite number of measurements. Is it possible to recover the distribution reliably if the data are incomplete. (71 refs.)

69045 Display of 3D information in discrete 3D scenes produced by computerized tomography. J.K.Udupa (Dept. of Radiology, Hospital of the Univ. of Pennsylvania, Philadelphia, PA, USA).
Proc. IEEE (USA), vol.71, no.3, p.420-31 (March 1983).
Imaging modalities such as X-ray computerized tomography (CT), ultrasound CT, and nuclear magnetic resonance CT all produce sequences of slice images of internal structures of medical objects. Effective methods of displaying the D information in such images are essential to aid in both diagnosis and treatment of diseases. Two philosophically different approaches to the display problem have been pursued. In the first approach, 3D information is displayed as a distribution of densities in a 3D space. The second approach extracts, from slice images, information about boundary surfaces of objects which is displayed on a 2D screen. The present paper reviews both of these approaches with particular emphasis on the image and graphics processing aspects of the latter approach. (67 refs.)

Computerized tomography with ultrasound .... See Entry 68989

Magnetocardiographic observations of the human heart .... See Entry 68990

On the measurement accuracy of the tissue permittivity in vivo .... See Entry 68993

Evaluation system for absolute brightness from the retinal vessels .... See Entry 68994

An introduction to NMR imaging: from the Bloch equation to the imaging equation .... See Entry 68995

Signal processing in digital radiography .... See Entry 68996

The computer increases the sharpness of X-ray diagnosis .... See Entry 68997

Estimates of kidney volume by single photon emission tomography: a preliminary report .... See Entry 68998

Fully automated sectorial equilibrium radionuclide ventriculography. Proposal of a method for routine use: exercise and follow-up .... See Entry 68999

Measurement of changes of blood flow in renal transplants .... See Entry 69000

Positron production and PET scanning .... See Entry 69003

Liquid scintillation counting—perils and pitfalls .... See Entry 69007

Image quality evaluation of a digital fluorographic imaging device .... See Entry 69008

Applications of computerized tomography to diagnostic radiology .... See Entry 69009

Cardiac computed tomography .... See Entry 69010

High-speed three-dimensional X-ray computed tomography: the dynamic spatial reconstructor .... See Entry 69011

Single-photon emission computed tomography .... See Entry 69012

Application of computerized tomography to radiation therapy and surgical planning .... See Entry 69013

Overview of computerized tomography with emphasis on future developments .... See Entry 69014

Physical problems of computerized tomography .... See Entry 69015

Reconstruction algorithms: transform methods .... See Entry 69016

Finite series-expansion reconstruction methods .... See Entry 69017

Wiener spectral effects of spatial correlation between the sites of characteristic X-ray emission and reabsorption in radiographic screen-film systems ....See Entry 69018

Energy and angular dependence of X-ray absorption and its effect on radiographic response in screen-film systems ....See Entry 69019

A comparison of rotating slant hole collimator and rotating camera for single photon emission tomography of the heart ....See Entry 69020

87.70G Patient care and treatment

69046 **Problems of haemodynamic monitoring encountered in intensive care.** P.C.Baumann (Univ. Zurich, Zurich, Switzerland).
Biomed. Tech. (Germany), vol.28, no.5, p.105-11 (May 1983).
Invasive hemodynamic monitoring in an intensive care unit may be necessary for evaluating circulatory function, and to provide a basis for controlling therapy. Pressure monitoring using a balloon-tipped pulmonary artery catheter is an important element of such monitoring, and its problems are discussed here. For the patient, insertion of intravascular catheters may represent a certain stress, and complications may occur. Consequently strict criteria should be applied to the indication for hemodynamic monitoring. Since it is used at the bedside—frequently for periods for several days—concessions must be made regarding material, especially catheters. Errors of handling—e.g. calibration if this is not automatic, or in the choice of the zero reference level—are posible, and the interpretation of the data may cause problems. However, the majority of such problems and complications can be avoided or countered by using reliable material, and—even more important—by the care exercised by well-trained personnel charged with supervising the hemodynamic monitoring. (7 refs.)

69047 **Design of a cryogenic surgical instrument.** E.I.Mikulin, A.N.Antonov.
Izv. VUZ Mashinostr. (USSR), no.2, p.149-50 (1983). In Russian.
The temperature field around the cryogenic surgical instrument is determined by a simple localised method, employing preliminary temperature smoothing of the bio-tissue heat. Formulae are presented and results given for the position of the isotherm of the phase transition of the water in the bio-tissue at the time of the cooling process, and for the time-dependent temperature characteristics of different points of the bio-tissue under investigation, as a function of the geometry of the instrument rate of consumption of the cryogenic agent and properties of the bio-tissue. (2 refs.) *Z.F.V.*

69048 **Healthy potential of negative ions.** C.Fairbrother (Fairford Hospital, Fairford, England).
Indian & East. Eng., vol.124, no.10, p.441-2 (Oct. 1982). [received: March 1983]
The author describes developments in medical ionisers from the viewpoint of her specialisation in ophthalmic nursing. (no refs.)

69049 **Installation and testing of a hospital based cyclotron for radiation therapy and isotope production.** P.R.Almond, J.R.Marbach, V.A.Otte (Univ. of Texas System Cancer Center, M.D. Anderson Hospital & Tumor Inst., Houston, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1772-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A hospital based cyclotron is under installation at The University of Texas M.D. Anderson Hospital in Houston. This machine will be used for the production of radioactive isotopes and for the generation of neutrons for the radiotherapy treatment of cancer. It is a Cyclotron Corporation CP-42 negative proton accelerator. For neutron production the protons are transported through an isocentrically mounted beam transport system than can be rotated round the patient. The shielding requirements of this facility are described as are the initial measurements on the characteristics of the neutron beam. (6 refs.)

69050 **A medical cyclotron, facilities and program at the King Faisal Specialist Hospital and Research Centre Riyadh, Saudi Arabia.** R.C.Barrall, K.A.Merendino, N.Feteih (Cancer Therapy Inst., King Faisal Specialist Hospital & Res. Centre, Riyadh, Saudia Arabia).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1777-80 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A new Cancer Therapy Institute at the King Faisal Specialist Hospital and Research Centre in Riyadh, Saudi Arabia became fully operational in November 1982. The new building incorporates extensive facilities for the production of medically useful radionuclides and additional cancer treatment capability including two neutron therapy machines and an electron linear accelerator. (5 refs.)

69051 **The changing role of accelerators in radiation therapy.** W.F.Hanson (Dept. of Phys., M.D. Anderson Hospital & Tumor Inst., Houston, TX, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1781-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Conventional low energy X-rays have been used in radiation therapy since the turn of the century. Van de Graaff and Betatron accelerators changed the complexion of radiation therapy in the mid 1940s by providing significantly deeper penetrating photon beams and also providing therapeutic quality electron beams. The development of Cobalt-60 teletherapy in the mid 1950s suppresed the role of accelerators in radiation therapy for nearly 20 years. However, with the development of reliable isocentric rotating linear accelerators, accelerators are rapidly becoming the most popular conventional therapy devices. Following unfavorable clinical results with fast neutron therapy in the late 1930s and early 1940s, the role of cyclotron produced fast neutrons is presently experiencing a renewal in radiation therapy. Several facilities are also experimenting with heavy charged particle beams for therapy. (15 refs.)

69052 **Radiation therapy treatment: the role of treatment aids and accessories.** D.A.Goer (Varian Associates Inc., Palo Alto, CA, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1784-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The goal of successful Radiotherapy requires that treatment machines deliver a prescribed dose distribution to a prescribed target volume. The use of specially designed treatment aids and accessories can assist the radiotherapist in achieving this goal. This paper describes some of the recent developments in this area and suggests possible areas for future development efforts. (29 refs.)

69053 **Electrical stimulation of the spinal cord: a further analysis relating to anatomical factors and tissue properties.** W.K.Sin, B.Coburn (Dept. of Mech. Engng., Brunel Univ., Uxbridge, England).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.264-9 (May 1983).
The midsagittal plane of the human thorax is represented by a two-dimensional finite-element model. Solutions of steady-state potential fields of bipolar epidural stimulation are computer generated. Effects of biological tissue conductivity and geometry on the fields are studied. Interpretations in terms of current density show that variations of bone conductivity have little influence on the fields. For constant current stimulation, the presence of the tough dura mater, irrespective of its thickness, does not seem to be significant. In contrast, the crucial factor affecting the field is the width of subarachnoid space which contains the highly conductive cerebrospinal fluid. (7 refs.)

69054 **Equipment using an impedance technique for automatic recording of fluid-volume changes during haemodialysis.** B.Tedner (Dept. of Medical Engng., Karolinska Inst., Stockholm, Sweden).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.285-90 (May 1983).
An instrument for continuous monitoring of fluid-volume changes has been developed. A tetrapolar whole-body impedance technique is employed with a constant current of 100 μA at 1.5 kHz and 150 kHz. A microprocessor automatically calculates changes in fluid volume from changes in whole-body impedance. Body-surface area is used as a normalising factor together with an empirically determined constant to obtain readings expressed in litres. Estimates of fluid-volume changes obtained by the method were compared with concomitant changes in the body weight of ten patients undergoing haemodialysis, and a correlation coefficient of 0.89 was found. (11 refs.)

Advanced medical accelerator design ....See Entry 69004

The neutron therapy facility at the University of Pennsylvania-Fox Chase Cancer Center ....See Entry 69005

Heavy ion radiotherapy at the Lawrence Berkeley Laboratory ....See Entry 69006

Application of computerized tomography to radiation therapy and surgical planning ....See Entry 69013

A lyoluminescent tissue-equivalent dosemeter for pion therapy beams ....See Entry 69026

87.70J Prosthetics and other practical applications

69055 **A model to explain the effect of soft lens design specifications on movement.** M.M.Bibby (Ciba Vision Care, Atlanta, GA, USA), A.Tomlinson.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.287-91 (April 1983).
A model is presented which explains the movement of a contact lens in terms of its primary design specifications. The model is supported by clinical evidence. The interrelation between lens thickness, sagittal depth, and diameter is explained. The model explains why fewer base curves are needed as lens thickness is reduced. (9 refs.)

69056 **Validation of a model describing soft lens movement as a function of lens specification.** T.H.Cedarstaff, A.Tomlinson (School of Optometry, Indiana Univ., IN, USA), M.M.Bibby.
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.292-6 (April 1983).
The authors fitted 12 subjects with 30% water-content, soft contact lenses. The saggital depth of the lenses was varied in five steps while diameter was held constant. In a second study, diameter was varied from 12 to 14 mm in five steps. Regression analysis was used to analyze the data. Lens movement can be decreased by increasing lens thickness, reducing lens diameter or flattening the base curve of the lens. (12 refs.)

69057 **Effect of X-Chrom lens wear on chromatic discrimination and stereopsis in color-deficient observers.** E.R.Matsumoto, C.A.Johnson, R.B.Post (Dept. of Ophthalmology, Univ. of California, Davis, Ca, USA).
Am. J. Optom. & Physiol. Opt. (USA), vol.60, no.4, p.297-302 (April 1983).
Four color-deficient observers and one normal trichromatic subject were evaluated with color vision and stereoacuity tests during 1 month of X-Chrom lens wear. For all color tests, performance of the normal subject was unaltered by X-Chrom lens wear. Color-deficient subjects demonstrated improved performance on the Ishihara pseudoisochromatic color plates, but either degraded performance or no change on the Farnsworth-Munsell 100-hue or Pickford-Nicolson red-green anomaloscope test. Three of the five subjects exhibited degraded stereoacuity in conjunction with X-Chrom lens wear. It is concluded that the X-Chrom lens does not improve discrimination in color-deficient subjects and may alter stereopsis. (14 refs.)

69058 **Electrocutaneous code pairs for artificial sensory communication systems.** A.Y.J.Szeto (La Jolla Technol. Inc., San Diego, CA, USA).
Ann. Biomed. Eng. (USA), vol.10, no.4, p.175-92 (1982).
Pairs of electrocutaneous codes suitable for dual-channel sensory communication systems were compared using a dual-channel electrocutaneous tracking task. The tracking task required the test subject to dynamically respond to changes in the tactile sensation being modulated by two independent pseudorandom signals, one for each channel. The rule (or method) by which the signals changed the tactile sensations was called an electrocutaneous code. Four frequency variation codes and two intensity variation codes were paired in different combinations and then checked as to their effectiveness for sensor communications. The experimental protocol used a balanced incomplete block design which involved 24 subjects testing 3 of 8 code pairs each. Although the variance in the tracking performances between subjects was larger than the differences between the code pairs, learning rates for the various pairs were significantly different. The easiest one to learn was the Low Pulse Rate Modulation Code paired with itself. Other findings included the general superiority of monophasic stimulation code pairs over biphasic stimulation code pairs, the need for placement of the two electrodes on different dermatomes in order to achieve satisfactory dual-channel communications, and the greater sensitivity to electrocutaneous stimulation of the ventral side of the forearm versus its dorsal side. (29 refs.)

69059 **Design and fabrication of an experimental cochlear prosthesis.** G.E.Loeb, C.L.Byers, S.J.Rebscher, D.E.Casey, M.M.Fong, R.A.Schindler, R.F.Gray, M.M.Merzenich (Dept. of Otolaryngology, Univ. of California, San Francisco, CA, USA).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.241-54 (May 1983).
The technical and safety requirements for intracochlear electrical stimulation to restore hearing in the profoundly deaf are reviewed. A system has been implanted in human subjects which comprises a 16-contact flexible electrode array, radio receiver/stimulator and surgical disconnect which permits changing from percutaneous cable to transcutaneous telemetry. The design, fabrication, and mechanical and electrical testing of each of the components are discussed in detail. Major improvements over previous systems include controlled introduction of anisotropic flexing properties in the electrode array to

facilitate insertion and optimal contact orientation, enlarged and stabilised contact surface area and the development of a new connector technology which combines high density, high reliability, biocompatibility and ease of operation during surgery. (42 refs.)

Sintering of calciumphosphate ceramics for biomedical purposes ....See Entry 68492

Selectively absorbing glasses for the potential prevention of ocular disorders ....See Entry 69030

87.80 BIOPHYSICAL INSTRUMENTATION AND TECHNIQUES

69060 Blood platelet aggregometer: predicted effects of aggregation, photometer geometry, and multiple scattering. P.Latimer (Phys. Dept., Auburn Univ., Auburn, AL, USA).
Appl. Opt. (USA), vol.22, no.8, p.1136-43 (15 April 1983).
The in vitro aggregation of blood platelets is usually monitored with a visible light transmittance photometer (aggregometer). These cells in plasma are large ($\alpha=2\pi a/\lambda\simeq16$) soft ($m=1.04$) particles. The factors which significantly influence transmittance include the inherent scattering properties, multiple scattering, and photometer design. Now scattering theory and numerical methods for radiative transfer are used to survey how aggregation should influence transmittance as measured with various photometers. The results should help expand the analytical power of the transmittance photometer as a tool for monitoring aggregation. Evidence is also presented that scattering by aggregates of aerosol particles, which are of a higher relative refractive index, should also be adequately predicted by these approximate methods. (25 refs.)

69061 A device for the electrical measurement of the deformability of red blood cells. H.G.Roggenkamp, F.Jung, H.Kiesewetter (Rheinisch Westfalischen Tech. Hochschule Aachen, Aachen, Germany).
Biomed. Tech. (Germany), vol.28, no.5, p.100-4 (May 1983). In German.
For the measurement of red blood cell deformability a new device is introduced. The passage time of single erythrocytes passing a single pore in a membrane is determined as an index for red blood cell deformability. The total resistance of the measuring chamber is changed during the passage of an erythrocyte. The duration of this alternation of the resistance directly depends on the passage time. This electrical measurement signal is compared to the signal of the hitherto employed optoelectronical registration. (14 refs.)

69062 A programmable multiple-tone generator. J.Polich, A.Fischer, A.Starr (Dept. of Neurology, California Coll. of Medicine, Univ. of California, Irvine, CA, USA).
Behav. Res. Methods & Instrum. (USA), vol.15, no.1, p.39-41 (Feb. 1983).
A simple tone generator that allows software control of auditory stimuli is described. The circuit provides for the simultaneous generation, timing, and amplification of three different tones. Its low cost, ease of construction, and versatility make it an attractive alternative to conventional auditory stimulus hardware. (6 refs.)

69063 A low-cost solid state device for producing delayed auditory feedback. F.L.Yaffe (Washburn Univ., Topeka, KS, USA), L.Bostwick.
Behav. Res. Methods & Instrum. (USA), vol.15, no.1, p.42-4 (Feb. 1983).
Presents a design for construction of a relatively low-cost solid-state delayed auditory feedback device. The advantages of this unit are that it is reliable, flexible, easy to operate, and it does not require audio tape. (12 refs.)

69064 A microprocessor control system and solid state interface for controlling electrophysiological studies of conditioning. P.R.Solomon (Dept. of Psychology, Williams Coll., Williamstown, MA, USA), D.J.Weisz, G.A.Clark, J.Hall, B.A.Babcock.
Behav. Res. Methods & Instrum. (USA), vol.15, no.1, p.57-65 (Feb. 1983).
Describes a microprocessor control system and solid state interface for controlling the apparatus in combined behavioral-electrophysiological studies of conditioning. The computer program, which is designed to control classical conditioning of the rabbit's nictitating membrane response, provides the flexibility to control all conditioning parameters (e.g., interstimulus and intertrial intervals, trial type, and sequence of trial types) with only minor modification. The system is free from artifacts that can distort electrophysiological recordings and can easily be modified to accommodate other behavioral paradigms in which electrophysiological responses are recorded. (10 refs.)

69065 Ferritin as a label for high-gradient magnetic separation. C.S.Owen, J.G.Lindsay (Dept. of Biochem., Jefferson Medical Coll., Philadelphia, PA, USA).
Biophys. J. (USA), vol.42, no.2, p.145-50 (May 1983).
In three model systems, particles the size of cells or smaller have been surface labeled with ferritin to make them slightly paramagnetic, by virtue of the iron in the ferritin. In each case it was possible to show that labeled particles could be magnetically removed from a flowing suspension by the high-gradient magnetic separation (HGMS) technique. The first system of particles consisted of small (1 μm) carboxylate-modified latex spheres to which ferritin was covalently bound to create stable paramagnetic particles analogous to a ferritin-labeled subcellular membrane preparation. In the second system polyacrylamide beads that more closely approximated whole cells in size (5-50 μm) were labelled with immunoferritin. The third system was a biomembrane preparation erythrocyte ghosts labeled with a ferritin-lectin conjugate. A field of 7 T (tesla) (70 kG) was used in each case, along with buffer flow rates through the HGMS column in the range 0.1-1.0 ml/min. (24 refs.)

69066 A theoretical study on the sucrose gap technique as applied to multicellular muscle preparations. III. Methodical errors in the determination of inward currents. E.Lammel (Dept. of Physiology, Marburg, Germany).
Biophys. J. (USA), vol.42, no.2, p.159-70 (May 1983).
For pt.II see ibid., vol.36, p.555-73, 1981. The analysis of errors associated with saline-sucrose interdiffusion in sucrose gap experiments on multicellular muscle preparations described in pt.I and pt.II is extended to the determination of current-voltage relations that contain an activated inward current component. The membrane current-voltage (i_t-V_m) relation used in the computations was N-shaped and consisted of two components, an outward (background) current (i_{bg}) with properties of anomalous (inward-going) membrane rectification, and an inward current (i_s) resembling the slow inward current of cardiac muscle. Reconstruction of current-voltage relations, which simulate those determined experimentally, indicates that in the potential range in which the total membrane current (i_t) is outward, i_t is measured too high, whereas it is measured too low in the range of net inward current. Reversal potentials of the inward and outward components are both shifted to more negative values, that of the inward current being more affected. (35 refs.)

69067 Fluorescence monitoring of electrical responses from small neurons and their processes. A.Grinvald, A.Fine, I.C.Farber, R.Hildesheim (Dept. of Neurobiology, Weizmann Inst. of Sci., Rehovot, Israel).
Biophys. J. (USA), vol.42, no.2, p.195-8 (May 1983).
To improve the sensitivity of fluorescence measurements of electrical rsponses from small cells and their processes, the authors have optimized the optical measuring system. The fluorescence intensity from a stained cell was increased 40-fold relative to the authors' previous apparatus. The increased fluorescence intensity permits the use of an inexpensive photodiode (or a photodiode array) that has a ~10-fold higher quantum efficiency relative to a photomultiplier. Utilizing the improved apparatus, the authors optically recorded an action potential of a 2 μm wide neuronal process with a signal-to-noise ratio of ~50 (root mean square noise) without averaging. They also report the design of an improved fluorescence voltage-sensitive probe; the fractional change of the fluorescence signal under optimal conditions was 21%/100 mV. (15 refs.)

69068 Application of low energy proton beam for determination of elemental composition in healthy and pathological tissues. K.Durek (Acad. of Medicine, Krakow, Poland), L.Jarczyk, J.Oszacki, E.Rokita, A.Strzalkowski, M.Sych, A.Urban.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1310-12 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
In the aim of comparison of normal and pathological tissues two groups of samples were analysed. The first group consisted of gastric mucosa samples. Basing on the histological findings the samples were selected with different cancer cells count varying from very high value to the zero level (normal tissue). The second group of samples composed of blood serum, erythocytes, hairs and muscle tissue taken from patients with gall-bladder or gastric cancer and those with noncancer gastro-intestinal tract disease. Using PIXE method the concentrations of the following elements were determined: P, S, Cl, K, Ca, Ti, Cr, Mn, Fe, Ni, Cu, Zn, Se, Br, Rb, Sr and Pb. The significant differences of the content of various elements in normal and pathological tissue were observed. (4 refs.)

69069 PIXE using cyclotron and lung cancer pathogenesis. G.Weber, G.Robaye, P.Bartsch, A.Collignon, I.Roelandts, J.M.Delbrouck-Habaru (Dept. of Medicine, Univ. of Liege, Liege, Belgium).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1313-15 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The lung lobes of patients with bronchial carcinoma, removed during surgical operation were submitted to analysis of mineral content, by the particle induced X-ray emission (PIXE) method. The content of the tumor itself was measured and compared to the content of surrounding non-cancerous tissue. These results were then opposed to those previously obtained at autopsy from the lungs of patients in the same range of age, deceased of various non-cancerous diseases. The most striking finding was very high values for several elements around the tumour and, among them, the more constantly elevated were chromium, nickel and titanium which may reach tenfold values, compared with the reference group. (6 refs.)

69070 PIXE analysis of human hair samples. K.M.Varier (Dept. of Phys., Univ. of Calicut, Kerala, India), A.K.Nayak, G.K.Mehta.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1316-18 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
PIXE analysis of human hair samples was carried out with 2 MeV protons. The trace elemental contents in hair samples collected from different parts of the same person had standard deviations ranging from 17% to 28% whereas those from hair samples of different persons had standard deviations ranging from 26% to 69%. Significant differences in the trace levels in samples from different parts of the body of the same person suggests that the trace elemental absorption and accmulation in hair depends on the location of the hair in the body. The trace concentrations in white hair and black hair also showed differences. (13 refs.)

69071 Application of PIXE analysis to neurological diseases. R.W.Hurd, H.A.Van Rinsvelt, E.A.Perry, J.W.A.Kondoro, J.M.Andres, J.P.Mickle (Dept. of Neurosci., Univ. of Florida, Gainesville, FL, USA), B.J.Wilder, W.Maenhaut, L.De Reu.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1319-22 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
PIXE analysis was used to determine the elemental status of patients receiving the anticonvulsant valproic acid, patients with Reyes Syndrome, and animals with an experimentally-produced Reyelike disease. A result common to all studies was an alteration in selenium levels. (28 refs.)

69072 A comparison of PIXE and flame atomic spectrometry for hair analysis. E.Clayton (Lucas Heights Res. Lab., Australian Atomic Energy Comm., Sutherland, NSW, Australia), J.F.Chapman, K.K.Wooller.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1323-5 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The major components of hair have been determined using ion beam techniques. Trace element concentrations measured by PIXE are compared with an analysis on the same forty samples using flame atomic spectrometry. (9 refs.)

69073 Ion beam analysis of scalp hair as a monitor of occupational exposure. E.Clayton (Appl. Phys. Div., Lucas Heights Res. Lab., Australian Atomic Energy Comm., Sutherland, NSW, Australia), K.K.Wooller.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1326-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Proton Induced X-Ray Emission (PIXE) has been used in trace element analysis of human hair. Samples were charred, mixed with graphite spiked with yttrium (as an internal standard) pressed into pellets and bombarded with a 2.5 MeV proton beam. Concentrations of some twenty elements have been determined. The use of the method to monitor for Pb and As exposure as well as some miscellaneous element exposures is discussed. (9 refs.)

69074 The determination of platinum in human tissues with PIXE. T.G.M.H.Dikhoff, J.A.van der Heide, M.Prins (Eindhoven Univ. of Technol., Eindhoven, Netherlands), J.G.McVie.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p,1329-31 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Platinum levels as well as trace element concentrations in samples from cisplatin treated patients have been measured using the PIXE technique. The results were verified by neutron analysis for some elements. Spectral interferences of the platinum Lβ peak and selenium Kα have been solved by introducing a germanium layer as a selective absorber. The experiments are done in the frame work of a project on the assessment of the toxicity of cytostatic

platinum compounds. Preliminary results for liver, kidney and heart tissues are shown. (6 refs.)

69075 Trace element distribution at the subcellular level—possible correlation between zinc and mRNA. Ch.Ender, M.Q.Li, B.Martin, R.Nobiling, B.Povh, D.Reiss, K.Traxel (Max-Planck-Inst. für Kernphys., Heidelberg, Germany).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1332-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The trace element distributions at the subcellular level in a single cell have been analyzed using the Heidelberg scanning proton microprobe (SPM). The tip of growing pollen tube of Lilium longiflorum is characterized by a specific zonation. Through SPM analysis in the tip have obtained the element distributions for P, Ca, and Zn. Experimental results indicate that the trace element Zn is associated with a special zone, containing the smooth endoplasmic reticulum. The mRNA is also enriched in that zone; therefore a possible correlation between Zn and mRNA could exist. (13 refs.)

69076 Multi-element analysis of small biological samples. E.Rokita (Inst. of Phys., Jagellonian Univ., Cracow, Poland), W.Maenhaut, J.Cafmeyer.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1601-3 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A method combining PIXE and INAA was developed to determine the elemental composition of small biological samples. The method needs virtually no sample preparation and less than 1 mg is sufficient for the analysis. The method was used for determining up to 18 elements in leaves taken from Cracow Herbaceous. The factors which influence the elemental composition of leaves and the possible use of leaves as an environmental pollution indicator are discussed. (7 refs.)

69077 A system for dynamic analysis in biological systems with carbon-11. C.E.Nelson (Depts. of Radiology & Phys., Duke Univ., Durham, NC, USA), Y.Fares, J.D.Goeschl, C.E.Magnuson, C.H.Jaeger, B.R.Strain, E.G.Bilpuch.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1801-4 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
An integrated approach to the study of effects of environmental factors on plants is described. The system relies on the continuous labelling and measurement of naturally occurring tracer activity as it courses through the plant. These features allow the investigation of the magnitude of the photosynthate distribution, the transport times of photosynthates, and the dynamic response of the distribution to environmental factors. A host of ecologically, agriculturally and genetically important questions can be answered with this technique, including the consequences of increased CO_2 concentration in the atmosphere, and other environmental effects. (6 refs.)

69078 Estimation of effective pulmonary capillary pressure in intact lungs. H.Holloway, M.Perry, J.Downey, J.Parker, A.Taylor (Dept. of Physiology, Coll. of Medicine, Univ. of South Alabama, Mobile, AL, USA).
J. Appl. Physiol. (USA), vol.54, no.3, p.846-51 (March 1983).
A method is described for estimating pulmonary capillary pressure in intact dog lungs. The vascular pressure transients after occlusion of a small pulmonary artery or vein with Swan-Ganz catheters were analyzed for the inflection point between rapid and slow components. This transition point was assumed to represent the beginning of the discharge of blood stored in pulmonary microvessels and defined as the effective capillary pressure. For the arterial pressure decay curves, the fast and slow components had rate constants of 0.77 and 0.25/s, respectively. Comparable inflection point capillary pressures were obtained with either digitized curves displayed in semilogarithmic fashion or direct visual inspection of the recorder chart of the same arterial pressure tracings. The effective capillary pressures obtained using wedge pressure tracings were well correlated with isogravimetric measurements of capillary pressure and should provide a useful method for evaluating the capillary filtration pressure in the lungs of intact animals or patients. (24 refs.)

69079 A procedure for determining angular positional data relative to the principal axes of the human body. P.Gervais (Dept. of Phys. Education, Univ. of Alberta, Edmonton, Alberta, Canada), G.W.Marino.
J. Biomech. (GB), vol.16, no.2, p.109-13 (1983).
Describes a simple computational procedure for determining angular displacement-time histories of human motion from three-dimensional cine data. The method is based on algebraic transformations of coordinates and coordinate axes. Through these coordinate transformations data was acquired for a multi-axial tumbling skill to illustrate angular displacement-time data relative to the moving coordinate system described by the human body through space. (7 refs.)

69080 Arterial tonometry: review and analysis. G.M.Drzewiecki, J.Melbin, A.Noordergraaf (Dept. of Bioengng., Univ. of Pennsylvania, Philadelphia, PA, USA).
J. Biomech. (GB), vol.16, no.2, p.141-52 (1983).
A review is presented of the field of arterial tonometry and of the problems involved with its application. A second generation model is developed which interprets most of the difficulties encountered in previous experimental work. The model also identifies barriers that must be overcome to allow tonometry to become a practical technique for obtaining measurement of continuous, absolute blood pressure. Problems addressed include those of calibration, positioning sensitivity, design standardization, material properties and vascular loading characteristics. Theoretical and experimental studies provide support for the application of basic biomechanical concepts for solution of these problems and suggest required design features. (46 refs.)

69081 A constant stress creep testing machine. S.Vogel, M.N.Papanicolaou (Dept. of Zoology, Duke Univ., Durham, NC, USA).
J. Biomech. (GB), vol.16, no.2, p.153-6 (1983).
A device is described which permits loading of highly extensible materials at constant stress while monitoring extension as a function of time. As presented, the device accommodates extensions of up to four times resting length, loads from 0.1 to 10 N, and specimen lengths from 1 to 5 cm. (4 refs.)

69082 Improved filtration method for red cell deformability measurement. Y.Kikuchi, T.Arai, T.Koyama (Div. of Physiology, Res. Inst. of Appl. Electricity, Hokkaido Univ., Sapporo, Japan).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.270-6 (May 1983).
A method which enables reliable measurements of red cell deformability in whole blood to be performed is presented. It is based on the Nuclepore filtration method described by Reid et al. (see J. Clin. Path., vol.29, p.855-8, 1976). Its reliability was much improved, obtaining an accuracy of within 5% by a technique to remove air bubbles trapped in the filter pores, which caused the poor reproducibility observed before. Simple analyses of the flow characteristics of whole blood and the haematocrit dependence of whole blood passage time were given to eliminate the effect of transient pore blockings of white cells and the contribution of different haematocrit in the whole blood passage time. A mean pore passage time of single red cells is obtainable as a quantitative index of red cell deformability. Furthermore, a good utilisation was achieved by making full use of electrically operated valves and aspiration pumps. It is possible to repeat measurements at intervals of 3 min. This improved filtration method will be useful for diagnostic purposes since it can avoid artefacts caused by artificial treatments added on blood samples and time changes after blood sampling. (15 refs.)

69083 Tilt-table/ankle-actuator system for the study of vestibulospinal reflexes. R.E.Kearney, I.W.Hunter, P.L.Weiss, K.Spring (Biomedical Engng. Unit, McGill Univ., Montreal, Quebec, Canada).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.301-5 (May 1983).
The vestibular system is thought to influence human postural control both by means of direct effects on motoneurons and by indirect interactions with somatosensory reflexes. Experimental investigation of vestibulospinal effects therefore requires the independent, dynamic manipulation of both somatosensory and vestibular inputs. The paper describes a system developed to provide this capability for human studies. It consists of a tilt table, whose angle of tilt is controlled by a linear hydraulic actuator, on which is mounted a rotary hydraulic actuator. Subjects are strapped to the table with the left foot connected to the rotary actuator. Both actuators are operated as position servos, allowing vestibular input to be controlled by dynamically varying the table's angle of tilt and somatosensory input to be controlled by manipulating the angular position of the ankle with the rotary actuator. The independent dynamic control of both vestibular and somatosensory inputs afforded by the tilt-table/ankle-actuator device makes possible the application of multiple input/output engineering systems analysis techniques. (25 refs.)

69084 CoSTEL: a computer peripheral remote sensing device for 3-dimensional monitoring of human motion. V.Macellari (Lab. di Ingegneria Biomedica, Istituto Superiore di Sanita, Roma, Italy).
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.311-18 (May 1983).
An automatic system (CoSTEL) which permits the reconstruction of the instantaneous 3-dimensional position of target points (infrared light emitting body markers) in a laboratory frame was designed. The 3-dimensional CoSTEL transducer is based on a suitable spatial arrangement of three one-dimensional transducers. Each transducer is made of a charge-coupled device linear array image sensor lying on the focal plane of a toroidal lens and appropriately aligned with it. The system was conceived for 3-dimensional whole body movement analysis and is able to track eight landmarks per subject side simultaneously. Its basic features are resolution of 1/4000, maximum sampling frequency 1.1 kHz (100 Hz is actually used), large insensitivity to background light and transducer output in digital form. These features provide a high level of accuracy, reliability and working stability. (14 refs.)

69085 Improved Ag/AgCl pressure electrodes. Y.J.Kingma, J.Lenhart, N.G.Durdle (Dept. of Electrical Engng., Univ. of Alberta, Edmonton, Alberta, Canada), K.L.Bowes, M.M.Chambers.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.351-7 (May 1983).
When electrodes are used to measure slowly varying signals such as the slow wave in the gastrointestinal tract (0.01 to 10 Hz) it is necessary that the impedances of the electrodes are low at these frequencies, and the drift must also be low. The authors have carried out a programme of (a) electrode surface pretreatment, (b) electrolytic AgCl deposition, (c) impedance measurements, (d) electrode storage methods and (e) noise and drift measurements. Optimal preplating treatment was found to be roughening of the cleaned Ag surface. The electrode impedance could be lowered by about an order of magnitude using 50 μm Al_2O_3 absrasive powder. Electrodes pretreated as described and optimally plated showed drift voltages of less than 1 μV min^{-1} and noise voltages of less than 1 μV. The low drift allowed the use of d.c. coupling during slow wave measurement on intestinal smooth muscle. The waveform in this case approximated the intracellular one closely. (7 refs.)

69086 An audiometer with automatic frequency selection. P.Bouchet, J.Pernier, P.Gerin (INSERM/CEMI, Bron, France), A.Morgon, A.Ubersfeld.
Med. & Biol. Eng. & Comput. (GB), vol.21, no.3, p.365-70 (May 1983). In French.
An audiometer, orientated towards frequency selection is realised using a microprocessor. The generation of sound signals is effected by a numerical method. Amplitude control of the signals is carried out with a minimum of circuits. The apparatus is self-checking in operation. A method of rapid and automatic research into hearing thresholds is presented. (4 refs.) *H.C.B.*

69087 Alpha-particle autoradiography in CR-39: a technique for quantitative assessment of alpha-emitters in biological tissue. A.P.Fews, D.L.Henshaw (H.H. Wills Phys. Lab., Univ. of Bristol, Bristol, England).
Phys. Med. & Biol. (GB), vol.28, no.5, p.459-74 (May 1983).
The techniques for α-particle autoradiography based on the plastic nuclear track detector CR-39, previously reported, have been developed considerably. The techniques are applied to α-autoradiography of human lung tissue in particular but are applicable to any biological tissue. The most important developments are: (i) Improvements in the manufacture and pre-etching of the plastic. These allow activities as low as $\sim 10^{-15}$ Ci g^{-1} to be determined. (ii) High resolution α-particle spectroscopy in CR-39 plastic based on the analysis of the structure of the etched track. This enables the energy of individual α-particles to be determined to $\sim$35 keV. (iii) Calculation of the effective thickness of tissue sampled by the plastic. This relates the tissue activity to the track density on the plastic. (iv) A deconvolution analysis which takes the distribution of track length and dip angle in the plastic and determines the α-particle range spectrum and distribution of tissue activity with height above the plastic surface. This enables both the absolute abundance and the microdistribution of α-active nuclides present to be determined. (v) The analysis of radon diffusion in tissue to determine the mean random diffusion distance in tissue and plastic. (15 refs.)

69088 Modeling of the Sino-Atrial node. M.Sameh Said (School of Engng., California State Univ., Fresno, CA, USA), A.A.R.Riad, S.M.Riad, K.Razzaghi.
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.199-203
An electrical model is established to simulate the operation of the SA node. Active networks (activators) are designed which when loaded by passive K and Na channels produce I-V characteristics identical to those of the SA node. Localized activation of SA node requires very little power as compared to pacemakers. (15 refs.)

Proceedings of the 21st Annual Conference of the Electron Microscopy Society of Southern Africa .... See Entry 64591

A compact synchroscan streak camera using a microchannel plate incorporated tube .... See Entry 66046

Possibility of the investigation of conformational changes in protein molecules with fluorescent probes in the picosecond time range .... See Entry 66062

Calorimetry and psiumetry .... See Entry 68929

Three-dimensional visualisation of velocity profiles in the ascending aorta in dogs, measured with a hot-film anemometer .... See Entry 68966

Description and application of an ultrasonic Doppler velocimeter for the small vessels .... See Entry 68988

Liquid scintillation counting—perils and pitfalls .... See Entry 69007

87.90 OTHER TOPICS IN BIOPHYSICS, MEDICAL PHYSICS, AND BIOMEDICAL ENGINEERING

Radiocarbon in the Weddell Sea as observed in a deep-sea coral and in krill .... See Entry 69253

The future of the Universe .... See Entry 69767

90.00 GEOPHYSICS, ASTRONOMY AND ASTROPHYSICS

91.00 SOLID EARTH GEOPHYSICS

91.10 GEODESY AND GRAVITY

(for relations of gravity observations to tectonics and isostasy, see 91.45 Physics of plate tectonics)

69089 Automatic relocation of ground control points in Landsat imagery. A.H.Benny (Space Dept., Royal Aircraft Establ., Farnborough, England).
Int. J. Remote Sens. (GB), vol.4, no.2, p.335-42 (April-June 1983).
Images obtained from the Landsat multispectral scanner are not provided in any normally recognised map projection system, so it is often necessary for a transformation to be made. This is usually done with the aid of ground control points, whose locations on the ground (or on a map) are accurately known and which can be accurately located within Landsat images. The initial selection and location of such ground control points is usually performed manually. For repeat imagery the same ground control points can be used. The positions of these points can be relocated within the repeat image either manually or, as described by the author, by an almost entirely automatic computer process. The process is developed for use with images of Britain but it could readily be adapted for worldwide use. (9 refs.)

69090 Spectral analysis of gravity and magnetic anomalies due to a vertical circular cylinder. A.Soto, S.K.Singh, C.Flores (Inst. de Geofisica, Ciudad Univ., Mexico City, Mexico).
Geophysics (USA), vol.48, no.2, p.224-8 (Feb. 1983).
Expressions for the spectra of gravity and magnetic anomalies due to a vertical right circular cylinder are written in terms of a Bessel function and the sum of two expotentials. From the zeros of the amplitude spectra, which are the zeros of the Bessel function, an estimate of the radius of the cylinder is obtained. The depths to the top and to the bottom enter as exponents of the exponential terms and are evaluated by taking ratios of the spectra at several frequencies. The density or the intensity of magnetization is then estimated. For the magnetic case the epicenter of the cylinder is obtained from the slope of the phase spectra. The method is tested on anomalies of various cylinders. (14 refs.)

69091 Rock density from borehole gravity surveys. T.R.LaFehr (EDCON Inc., Denver, CO, USA).
Geophysics (USA), vol.48, no.3, p.341-56 (March 1983).
Describes how borehole gravity meter (BHGM) recordings may be used to determine the density of rocks that do not occur in uniform horizontal strata. In the presence of anomalous masses, significant distortion in formation bulk density is possible. The apparent density anomaly produced in the well by an elongated, offset density contrast is proportional to the angle subtended by the density-change interface. For a density-change boundary having circular symmetry with respect to the well, the apparent density anomaly at the center of the bed is proportional to the sine of the subtended angle. Because the distortion in bulk density is the same above a horizontal boundary as it is just below an abrupt change in apparent density is equal to the real density change at the boundary. This change in density, termed 'the Poisson jump', is independent of geometry. Two methods are suggested for obtaining bulk densities from BHGM apparent densities: (1) by obtaining two stations just outside as well as just within the zone of interest, the Poisson jump can be approximated and added to an independent density source (e.g. the gamma-gamma log), and (2) the apparent density anomaly within the formation of interest can be derived by modeling (perhaps based on seismic or well data) and added to the BHGM-determined densities. (14 refs.)

69092 A least-squares approach to depth determination from gravity data. O.P.Gupta (KDM Inst. of Petroleum Exploration, Dehradun, India).
Geophysics (USA), vol.48, no.3, p.357-60 (March 1983).
Deals with a numerical approach to determine the depth of a buried structure from the residual anomaly. The problem of depth determination has been transformed into the problem of finding a solution of a nonlinear equation of the form $f(z)=0$. Formulas have been derived for a sphere, vertical and horizontal cylinders, and for a vertical fault (thin plate approximation). The procedure is applied to synthetic data with and without random errors. Finally, a field example is presented in which the depth to a fault is estimated at 3.8 km and verified from drilling results. (9 refs.)

69093 Approximate method for direct interpretation of gravity anomalies caused by surface three-dimensional geologic structures. J.Svancara (Geofyzika Brno, Brno, Czechoslovakia).
Geophysics (USA), vol.48, no.3, p.361-6 (March 1983).
An efficient method for direct transformation of gravity anomalies into contour lines of depth is proposed. The method is applicable for surface three-dimensional bodies whose shape may be approximated by a cone at the first step. Hypothetical and field data evaluations presented here prove the efficiency of the method. (5 refs.)

69094 Palaeolatitudes from DSDP Leg 73 sediment cores: implications for the apparent polar wander path for Africa during the late Mesozoic and Cenozoic. L.Tauxe (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA), J.Besse, J.L.LaBrecque.
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.315-24 (May 1983).
Palaeolatitudes estimated from DSDP sediments provide important constraints on the apparent polar wander path (APWP) of Africa during the Cenozoic. A revised APWP is suggested based on new information about palaeomagnetic poles from the African continent and predicted palaeolatitudes are compared with those determined from Leg 73 sediments. Other published paths are discussed. (44 refs.)

69095 Palaeomagnetism of the Proterozoic Zig-Zag Dal Basalt and the Midsommerso dolerites, eastern North Greenland. C.Marcussen, N.Abrahamsen (Lab. of Geophys., Univ. of Arhus, Arhus, Denmark).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.367-87 (May 1983).
Palaeomagnetic investigations are reported from 24 sites in the Proterozoic Zig-Zag Dal Basalt Formation and 12 sites in the Midsommerso dolerites of eastern North Greenland. The Zig-Zag Dal Basalt is a typical tholeiitic flood basalt sequence, and dolerite intrusions in the underlying sandstones are thought to be genetically related to the basalts. After a detailed AF demagnetisation programme 19 sites in the basalts and 10 sites in the dolerites reveal one stable component of magnetisation, probably of TRM and/or CRM origin residing in small single domain titanomagnetite grains. The degree of anisotropy has not affected the direction of the remanent magnetisation. The maximum axis of the anisotropy ellipsoid is parallel to the flow direction of the magma, whereas the minimum axis is perpendicular to the flow plane. (44 refs.)

69096 Atmospheric angular momentum fluctuations, length-of-day changes and polar motion. R.T.H.Barnes, R.Hide, A.A.White, C.A.Wilson (Geophys. Fluid Dynamics Lab., Meteorological Office, Bracknell, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.31-74 (8 May 1983).
The authors re-examine some aspects of the theory of nonrigid body rotational dynamics and angular momentum exchange between the atmosphere and solid Earth. They show that partial integration leads to an expression involving simple functions—the equatorial angular momentum functions—which can be reliably evaluated from available meteorological data. The length-of-day problem is treated in terms of a similar axial angular momentum function, and effective angular momentum functions are defined in order to allow for rotational and surface loading deformations of the Earth. Daily values of these atmospheric angular momentum functions have been calculated, and are presented for the period 1 January 1981-30 April 1982. Finally they demonstrate that meteorological phenomena provide an important contribution to the excitation of polar motion. (37 refs.)

69097 Correlation of changes in gravity, elevation, and strain in southern California. R.C.Jachens, W.Thatcher, C.W.Roberts, R.S.Stein (US Geological Survey, Menlo Park, CA, USA).
Science (USA), vol.219, no.4589, p.1215-17 (11 March 1983).
Measurements made once or twice a year from 1977 through 1982 show large correlated changes in gravity, elevation, and strain in several southern California networks. Precise gravity surveys indicate changes of as much as 25 microgals between surveys 6 months apart. Repeated surveys show that annual elevation changes as large as 100 millimeters occur along baselines 40 to 100 kilometers long. Laser-ranging surveys reveal that coherent changes in areal strain of 1 to 2 parts per million occurred over much of southern California during 1978 and 1979. Although the precision of these measuring systems has been questioned, the rather good agreement among them suggests that the observed changes reflect true crustal deformation. (18 refs.)

A geometric approach for mapping of derivatives .... See Entry 64661

An explanation for contradictory geodetic strain and fault plane solution data in western North America .... See Entry 69142

Continental lithospheric thickness and deglaciation induced true polar wander .. .. See Entry 69143

Large-scale gravity profiles across subducted plates .... See Entry 69160

Tectonic evolution of the southwest Indian Ocean since the mid-Cretaceous: plate motions and stability of the pole of Antarctica/Africa for at least 80 Myr .... See Entry 69164

Geodynamics and seismicity of the Pamir-Himalayas region ... See Entry 69167

Gravity study of the Central African Rift System: a model of continental disruption. I. The Ngaoundere and Abu Gabra rifts .... See Entry 69180

Gravity study of the Central African Rift System: a model of continental disruption. II. The Darfur domal uplift and associated Cainozoic volcanism .... See Entry 69181

Automatic mapping of lakes for small-scale maps using digital Landsat imagery .... See Entry 69263

Airborne gravity is here! .... See Entry 69364

Werner deconvolution of profile potential field data .... See Entry 69366

Satellite orbit perturbations due to the deforming potential of centrifugal forces .... See Entry 69473

The last 14 days of Skylab 1: orbit determination and analysis .... See Entry 69476

Star transits with a photoelectric micrometer applied to the transit instrument of Torino Observatory .... See Entry 69501

91.25 GEOMAGNETISM AND PALAEOMAGNETISM; GEOELECTRICITY

69098 Modeling of self-potential anomalies near vertical dikes. D.V.Fitterman (Denver Federal Center, US Geological Survey, Denver, CO, USA).
Geophysics (USA), vol.48, no.2, p.171-80 (Feb. 1983).
The self-potential (SP) Green's function for an outcropping vertical dike is derived from solutions for the DC resistivity problem for the same geometry. The Green's functions are numerically integrated over rectangular source regions on the contacts between the dike and the surrounding material to obtain the SP anomaly. The analysis is valid for thermoelectrical source mechanisms. Two types of anomalies can be produced by this geometry. When the two source planes are polarized in opposite directions. A monopolar anomaly is produced. When the thermoelectric coefficients changes monotonically across the dike, a dipolar anomaly is produced. Field data collected over a hot intrusive fissure are presented which have been modeled by the technique described. (15 refs.)

69099 Electromagnetic soundings in the sedimentary basin of southern Ontario—a case history. E.Gomez-Trevino, R.N.Edwards (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Geophysics (USA), vol.48, no.3, p.311-30 (March 1983).
The results of electrical and electromagnetic (EM) soundings conducted in the sedimentary basin of southern Ontario are presented. The sounding sites are located strategically to take advantage of the dipping nature of the sediments, a progressive study being undertaken from shallow to deep sections. The vertical magnetic field transfer function, estimated with a pseudonoise source EM system, and conventional Schlumberger apparent resistivity are jointly inverted. For each site, the layered Earth model containing the minimum number of layers is fitted to the data. The joint inversion enables up to eight distinct layers to be identified at some sites. The nonuniquenesses or ambiguities in each model are revealed through an eigensolution analysis. The intrinsic ambiguities of the models of the deeper sections are resolved by a systematic, progressive site-to-site correlation of electrical units across the basin. (18 refs.)

69100 DC telluric fields in three dimensions: a refined finite-difference simulation using local integral forms. J.F.Hermance (Dept. of Geological Sci., Brown Univ., Providence, RI, USA).
Geophysics (USA), vol.48, no.3, p.331-40 (March 1983).
A new finite-difference form is developed for simulating the distortion of telluric fields by 3-D azimuthally symmetric structures. The technique involves a sequence of local integrations of the electric current density crossing closed surfaces surrounding each mesh node. The resulting expressions, which are accurate to second degree everywhere, correctly describe first-order discontinuities in the electric field normal to electrical discontinuities in the interior of the model. Moreover, the new form (a nine-point finite-difference operator) accounts for cross-derivative (e.g. $\partial^2U/\partial r\partial z$) effects in the region about each node, which can lead to significantly improved accuracy near sharp, localized discontinuities where the anomalous field decays as $1/R^2$ or $1/R^3$ with distance. Numerical simulations are compared with analytical solutions for two simple models: (1) a circular disk-shaped heterogeneity in a thin-sheet; and (2) a sphere imbedded in a homogeneous, infinite medium. The comparison between the analytical and numerical results for both of these models indicates that an accuracy of better than a few percent is not exceptional. (17 refs.)

69101 Analysis of aeromagnetic measurements from the Cascade Range in central Oregon. G.Connard (Northwest Geophys. Associates Inc., Corvallis, OR, USA), R.Couch, M.Gemperle.
Geophysics (USA), vol.48, no.3, p.376-90 (March 1983).
Aeromagnetic measurements in the central Cascades between 43° and 44° N latitude and 121° and $122^1/_2$° W longitude exhibit predominant northwest-southeast lineations and less prominent north-northeast by south-southeast lineations. Longer wavelength components of the magnetic anomalies possibly related to deeper sources, trend approximately north-south parallel to the Cascade Range. Magnetic anomalies show a right-lateral offset of the High Cascades Volcanism at $43^1/_2$° N latitude. Magnetic source depth calculations show that the High Cascades occupy a structural depression or graben on the eastern side of the Western Cascades. Spectral analysis of the magnetic anomalies suggests that the High Cascades are underlain by Curie-point isotherm depths as shallow as 9 km. These shallow Curie-point isotherm depths imply thermal gradients greater than 50°C/km and surface heat flow greater than 100 $\mathrm{mW/m^2}$. (46 refs.)

69102 The distribution of electric conductivity on the eastern border of the West African craton (Republic of Niger). M.Ritz (Centre ORSTOM, Obs. Geophys., Dakar, Senegal).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.475-88 (May 1983).
Magnetotelluric soundings (MT) were conducted along the 14th parallel on the eastern border of the West African craton in the Republic of Niger. This profile includes eight sites an average of 30 km apart. The author determines the regional structure of electric conductivity and its relation to the various geologic belts covered. This study took place within a 15-500 s period band. Two-dimensional modelling suggests that, in the sites located on the sedimentary basin and the mobile belt, there exists a conductive layer in the upper mantle at a depth of 80 km. Within the craton the author is unable to prove the existence of this conductive layer. There also exists another conductive layer at the crust—upper mantle boundary at a depth of 30 km, but this seems to disappear in the cratonic belt. (23 refs.)

69103 The frequency response of the horizontal magnetic field for a conductive channel. D.Hebert (Dept. of Phys., Univ. of Victoria, Victoria, BC, Canada).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.577-80 (May 1983).
Babour & Mosnier's (1979) results showing no frequency dependence between the anomalous horizontal magnetic field above a conductor and the difference between the horizontal magnetic fields above and below the conductor over a wide range of frequencies led them to conclude that this effect is due to current channelling. A two-dimensional numerical model of a conductive channel, with a uniform horizontal source field, shows the same effect over a wide range of frequencies. Thus local induction can show the same effect. (6 refs.)

69104 Comment on 'A paleomagnetic record from Tangle Lakes, Alaska: large amplitude secular variation at high latitudes' by K.L. Verosub. G.M.Turner (Dept. of Phys., Victoria Univ., Wellington, New Zealand).
Geophys. Res. Lett. (USA), vol.10, no.3, p.185 (March 1983).
For original see ibid., vol.9, no.8, p.823-6 (1982). Verosub (1982) reports unexpectedly large amplitude geomagnetic secular variations from the palaeomagnetic record of a section of core spanning the period 4560 to 2880 yr BP from Tangle Lakes, Alaska, and he infers large scale changes in the dipole or nondipole magnetic field during this period. The author argues that an unexpected result obtained from a single record may not be reliable. The observed variation may have been produced by a twisting of the core tube during the coring procedure, or it may be the result of variations in the palaeomagnetic recording process in the sediments. It is concluded that the reported secular variation requires verification. (7 refs.)

69105 Pre-23 magnetic anomalies between Jan Mayen and Greenland-Senja fracture zones in the Norwegian Sea. T.Hagevang (Saga Petroleum A/S, Hovik, Norway), O.Eldholm, I.Aalstad.
Mar. Geophys. Res. (Netherlands), vol.5, no.4, p.345-63 (1983).
Analysis of magnetic data between the Jan Mayen and Senja fracture zones indicates that the anomaly 24A-B sequence extends from the Lofoten Basin onto the outer Voring Plateau. Anomaly patterns, including those on the conjugate margin, suggest that the pre-23 sea floor spreading was characterized by an unstable plate boundary between fracture zones. The pre-23 spreading rate was at least 2.5 $\mathrm{cm\ yr^{-1}}$ which is remarkably high compared with the post-23 rates. An evolutionary model which assumes Cenozoic oceanic crust as far landward as the Voring Plateau and Greenland escarpments is suggested. (34 refs.)

69106 Seamount magnetism in the Ionian Sea, eastern Mediterranean. Z.Ben-Avraham (Israel Oceanographic & Limnological Res. Ltd., Haifa, Israel), C.G.A.Harrison, E.Klein, Y.Shoham.
Mar. Geophys. Res. (Netherlands), vol.5, no.4, p.389-404 (1983).
Several seamounts in the Ionian Sea, the largest unit in the eastern Mediterranean, have magnetic anomalies. The magnetization vectors of six of these seamounts have been calculated. These paleomagnetic data suggest that the Ionian Sea is composed of several crustal units which came to their present location from different directions. This implies that there has been relative motion in the past between various land masses around the Ionian Sea. The possibility that the Ionian Sea is composed of several crustal units is supported by observations of the magnetic field over the area which is of different character in the north and south. The major limitation in applying the paleomagnetic data into an evolutionary scheme is that all the seamounts in the Ionian Sea as well as its crust are undated. (33 refs.)

69107 Cross-over analysis of marine magnetic anomalies. J.Verhoef, R.D.Scholten (Vening Meinesz Lab., Univ. of Utrecht, Utrecht, Netherlands).
Mar. Geophys. Res. (Netherlands), vol.5, no.4, p.421-35 (1983).
Using cross-over analysis the reduction of total magnetic intensity values to magnetic anomalies was studied in an area with ship-tracks which have been made over a period of several years. Under these circumstances the secular variation becomes important. At first the authors used the old IGRF 1975. This reference field does not correct the secular variation accurately. In the period 1969-1980 the mean values of the differences of the magnetic anomalies at crossings rise to more than 150 nT. The recently adopted reference fields DGRF 1965, DGRF 1970, DGRF 1975 and PGRF 1975 correct the secular variation much better. The mean values now only rise to about 50 nT over the same period. A reduction using a regional determined by filtering along the track removes the secular variation completely. The latter reduction has the disadvantage that the standard deviations of the mean values at the intersections increase, because the regional depends on the orientation of the track line. Calculation of average secular variation in subareas of 4×4 degrees yields a decrease from the northeast to the southwest. (15 refs.)

69108 Geomagnetic induction effects in ground-based systems. L.J.Lanzerotti.
Space Sci. Rev. (Netherlands), vol.34, no.3, p.347-56 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Plasma physics processes, whose ultimate origin is the Sun, exist in the Earth's magnetosphere and ionosphere and can produce effects which are detrimental to the operation of technological systems associated with long conductors deployed on the Earth's surface. Geomagnetic fluctuations produced by such plasma processes can cause disturbances and disruptions in cable communication systems, electrical power distribution systems, and long pipelines. This paper briefly addresses these three topics with illustrative examples of some measured effects from each topic area. (43 refs.)

69109 Magnetotelluric results opposing magma origin of crustal conductors in the Rio Grande rift. G.R.Jiracek, E.P.Gustafson, P.S.Mitchell (Dept. of Geological Sci., San Diego State Univ., San Diego, CA, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.299-326 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Although conductive intracrustal layers appear to be characteristic of continental rift zones, they also have been detected in stable crustal environments. The low-resistivity layers are often explained by free water or crustal magma; however, alternative explanations are possible. Two-dimensional analysis of a portion of 25 new magnetotelluric stations in the central Rio Grande rift supports the presence of a conductive zone at 10 km depth or less. However, very significant differences are apparent in the crustal sections at two close localities. Mid-crustal magma lenses, well-defined by seismic data, cannot explain these differences. Only the possible effects of regional three-dimensional current channeling could conceivably alter this conclusion. To explain the unexpected result, it is suggested that a conductive horizon occurs where an impermeable, ductile cap traps pore fluids beneath. Where active magma injection destroys the integrity of the ductile cap, trapped fluids may escape and produce an overall decrease in conductivity.

69110 Remote sounding of the Earth's resistivity-depth profile. M.El-Raey (Dept. of Phys., Univ. of Alexandria, Alexandria, Egypt).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.981-7 vol.1
The analogy of the inverse problem of underground resistivity sounding by two current electrodes and two colinear potential electrodes to the general remote sensing integral equation of radiative transfer, is demonstrated. Kernels of resistivity sounding have been shown to have maxima at depths determined by interelectrode spacing, as well as by the resistivity profile itself. Chahine's (1972) nonlinear relaxation technique have been suggested to retrieve resistivity profiles to depths determined by maximum current penetration. Optimum interelectrode spacing required to reduce the number of surface measurements have been determined by suitable choice of kernels. A technique is suggested in which a uniform resistivity depth profile is used to calculate initial kernels. Implications are drawn by analogy to the atmospheric sensing problem. (20 refs.)

Spectral analysis of gravity and magnetic anomalies due to a vertical circular cylinder .... See Entry 69090

Palaeolatitudes from DSDP Leg 73 sediment cores: implications for the apparent polar wander path for Africa during the late Mesozoic and Cenozoic .... See Entry 69094

Palaeomagnetism of the Proterozoic Zig-Zag Dal Basalt and the Midsommerso dolerites, eastern North Greenland .... See Entry 69095

Palaeomagnetic data about southern Tibet (Xizang). I. The Cretaceous formations of the Lhasa block .... See Entry 69161

Tectonic evolution of the southwest Indian Ocean since the mid-Cretaceous: plate motions and stability of the pole of Antarctica/Africa for at least 80 Myr .... See Entry 69164

Paleomagnetism of the Bonin Islands and its tectonic significance .... See Entry 69187

Microwave properties of saturated reservoirs .... See Entry 69194

Microscopic mechanisms of magnetic rock forming .... See Entry 69199

The effect of magnetostatic interaction on the magnetization of the ensemble of ferromagnetic mineral single domain particles .... See Entry 69200

Resistivity/depth mapping with airborne electromagnetic survey data .... See Entry 69362

Werner deconvolution of profile potential field data .... See Entry 69366

Analysis of palaeomagnetic time series—techniques and applications ....See Entry 69369

Review of archaeointensity methods ....See Entry 69370

Survey of high resistivity basement by common measurement of electric and magnetic fields of quasi-stationary point sources ....See Entry 69380

Dynamic sampling. A numerical solution and employment of Fourier transformation for describing the IP effect by system characteristic functions ....See Entry 69381

The maximum entropy method (MEM), determination of time series spectra by MEM ....See Entry 69382

Use of maximum entropy method in geomagnetic time series . See Entry 69383

Ring core magnetometers at 200°C [oil well application] .... See Entry 69392

91.30 SEISMOLOGY

69111 Effect of initial stresses on reflection and transmission of seismic waves at the Earth's core-mantle boundary. A.Chattopadhyay, M.Chakraborty (Dept. of Phys. & Math., Indian School of Mines, Dhanbad, India).
Arch. Mech. (Poland), vol.34, no.1, p.61-72 (1982).
The influence of initial stresses is shown on the reflection and transmission of *P* and *SV*-waves at the Earth's core-mantle boundary. The initial stresses have been taken as compressive and hydrostatic in nature. Results have been shown by graphs and tables for some particular values of initial stresses and compared with the classical results. It is concluded that initial stresses have significant effects on the reflection and transmission coefficients, and on the energy partition and critical angles of total reflection and transmission. (8 refs.)

69112 Effects of irregularity on the propagation of guided SH-waves. A.Chattopadhyay, M.Chakraborty, A.K.Pal (Dept. of Phys. & Math., Indian School of Mines, Dhanbad, India).
J. Mec. Theor. & Appl. (France), vol.2, no.2, p.215-25 (1983).
The aim is to study the propagation of guided SH-waves in an internal stratum with an irregularity of the interface. A homogeneous and isotropic internal stratum is considered with a parabolic irregularity in the lower interface, lying between two semi-infinite homogeneous and isotropic elastic half-spaces. The dispersion curves for different sizes of irregularity have been drawn for the fundamental mode and are compared with that for the medium without any irregularity. It has been observed that the presence of irregularity in the interface has the effect of lowering the phase velocity of the waves particularly in the low period range. (16 refs.)

69113 The influence of out-of-plane surface properties on unmigrated time sections. J.K.Cohen, N.Bleistin (Dept. of Math., Univ. of Denver, Denver, CO, USA).
Geophysics (USA), vol.48, no.2, p.125-32 (Feb. 1983).
Both analytic and numerical means are used to demonstrate amplitude and phase behaviour of reflections from three-dimensionality curved interfaces. In particular, the high-frequency geometrical optics approximation for the backward scattered wave field demonstrates that the phase of a reflection from a syncline is determined by the (in general, different) positions of focal regions for the two principal curves at the specular reflection point. Thus the amplitudes and phases of events observed on seismic sections are influenced as much by the shape of the reflector 'out-of-the-plane', as by the shape of the plane of the section. Results of the numerical examples suggest possible pitfalls in traditional interpretation of two-dimensional seismic data. (3 refs.)

69114 Attenuation and anisotropy of channel waves in coal seams. D.J.Buchanan, P.J.Jackson, R.Davis (Mining Res. & Dev. Establ., Nat. Coal Board, Burton-on-Trent, England).
Geophysics (USA), vol.48, no.2, p.133-47 (Feb. 1983).
In recent years channel-wave seismology has shown itself to be a useful aid to coal mining. The useful range of the method in a particular seam depends critically on the rate at which channel waves in the frequency range of interest (50 to 500 Hz) are attenuated during passage through the coal; when no faulting is located by a given survey, it is always important to know at what range a fault would have been detected had it been present. To this end, the attenuation and the anisotropy of the group velocity are discussed. (31 refs.)

69115 Seismic reflections from a gas-water contact. N.C.Dutta, H.Ode (Shell Dev. Co., Bellaire Res. Center, Houston, TX, USA).
Geophysics (USA), vol.48, no.2, p.148-62 (Feb. 1983).
Using the Biot theory, the authors perform calculations to show that viscous fluid flow affects seismic wave amplitudes and reflection coefficients as a gas-water boundary in a porous sand reservoir. The formulation of the boundary value problem for fluid-filled porous rocks is applicable at all angles and follows parallel to the classical reflection and transmission problem solved by Knott, Zoeppritz, and others for two elastic mediain perfect contact. It is pointed out that there are two major differences between the two: (1) in the present case, the authors deal with the propagation of inhomogeneous waves, and (2) there are interference fluxes of energy between various types of waves. The latter exists only at an oblique incidence. (20 refs.)

69116 Inverse scattering for a layered acoustic medium using the first-order equations of motion. M.S.Howard (Exploration Res. Div., Conoco Inc., Ponca City, OK, USA).
Geophysics (USA), vol.48, no.2, p.163-80 (Feb. 1983).
The inverse scattering problem for a layered acoustic medium is considered from the first-order differential equations of motion, resulting in a vector formulation of the problem, and using a vector form of the Schrodinger inverse scattering methods. The result is a vector Marchenko equation. The solution for plane waves at normal incidence is given along with a good approximate solution which is easily obtainable and takes into account transmission losses not included in the normal WKBJ-Born approximation. A new solution for extracting separately the velocity and density of the medium using the reflection response for two different angles of incidence is given. (15 refs.)

69117 Normal incidence layered system state-space models which include absorption effects. F.Aminzadeh (Univ. of Southern California, Los Angeles, CA, USA), J.M.Mendel.
Geophysics (USA), vol.48, no.3, p.259-71 (March 1983).
It is shown how to include absorption effects in a normal incidence state-space model of a layered media system. Two models are discussed: a convolutional state-space model and a differential-delay state-space model. Extensive results are presented for the former model, whereas only formulative results are presented for the latter. For the convolutional state-space model the authors develop absorption impulse responses in closed form for Gaussian and exponential absorption operators. Simulation results demonstrate that this model has the desired low-pass filtering effect expected of a system with absorption losses. The differential-delay state-space model does not appear to have been applied before in the context of seismic modelling. The authors suggest it as a useful model. (20 refs.)

69118 Applications of operator separation in reflection seismology. D.L.Brown (Dept. of Geophys., Stanford Univ., Stanford, CA, USA).
Geophysics (USA), vol.48, no.3, p.288-94 (March 1983).
The principle of operator separation, a generalization of operator splitting, is applied to some problems in reflection seismology. In particular, the examples of wave-equation migration of seismic data in a three-dimensional medium and accurate depth migration in a laterally varying medium are considered in light of this theory. For the case of a stratified three-dimensional medium, the standard dimensional splitting technique used in the downward-continuation step of the migration process can be replaced with full dimensional separation. The computational implications of this result are that the wave field array need only be transposed once during the downward continuation rather than 2*n* times, where *n* is the number of finite-difference steps taken in the calculation. (9 refs.)

69119 Lattice filtering applications to deconvolution of seismic data. J.C.Robinson (Cities Service Co., Energy Resources Group, Tulsa, OK, USA).
Geophysics (USA), vol.48, no.3, p.295-310 (March 1983).
Lattice digital filtering techniques have only recently been exposed to any significant extent through the technical literature, primarily in articles not directly related to reflection seismology. The most basic 'all-zero' lattice filter dates back only around a decade. This paper first reviews current technology in adaptive lattice filtering from the standpoint of seismic deconvolution. An 'all-pole' deconvolution technique is developed next; then a new 'pole-zero' lattice is adapted to seismic deconvolution, and operational methodologies for its effective implementation and stabilization are developed. Some advantages of deconvolution by lattice filtering and other potential applications of lattice filters to seismic data processing are suggested. The adaptive abilities and effectiveness of seismic deconvolution by the three lattice types are tested and compared with stationary Wiener deconvolution. (24 refs.)

69120 Frequency dependence of the quality factor in the upper crust: a deep seismic sounding approach. F.Thouvenot (Lab. de Geophys. Interne, IRIGM, Grenoble, France).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.427-47 (May 1983).
Ray amplitudes are computed in a one-dimensional velocity structure where the quality factor *Q* varies continuously with depth. An iterative process is then proposed to derive the quality factor distribution in the upper crust from deep sounding data. Results for compressional waves in the French Massif Central and for a signal frequency close to 20 Hz show that *Q* increases in a rather linear way from about 40 in surface up to 600 at 7 km depth. *Q* seems to be higher in the Central Alps: 180 in surface, 1600 at 5 km depth (at 20 Hz). Using proper signal processing, the frequency dependence of *Q* is investigated in the frequency range 10-25 Hz. (25 refs.)

69121 Bilateral propagation of a spontaneous two-dimensional anti-plane shear crack under the influence of cohesion. A.K.Chatterjee, L.Knopoff (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.449-73 (May 1983).
Considers the problem of the bilateral extension of a two-dimensional anti-plane shear crack that initiates spontaneously at a point and extends under the influence of cohesive forces at the edges. An approximation to the stresses in the regions beyond the edges of the crack has been found that simplifies the calculation. The exact stresses in these regions are also found iteratively. It is found that if healing is initiated due to the encounter of one end of a uniformly propagating crack with an unbreakable barrier, the static stress drop in the torn region is constant but may either overshoot or undershoot the dynamical stress drop. In these cases, the final static slip distribution is obtained by freezing the dynamic solution along a characteristic line through the location of the barrier. (24 refs.)

69122 Complex distribution of large thrust and normal fault earthquakes in the Chilean subduction zone. M.Malgrange, R.Madariaga (Dept. Sci. Phys. de la Terre, Univ. Paris VII, Paris, France).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.489-505 (May 1983).
Presents the results of a systematic study of events with $M_s > 6$ in northern Chile (20-33°S), for the period between 1963 and 1971. Medium to large earthquakes near the coast of this region are of three types: (1) Interplate events at the interface between the downgoing slab and the overriding South American plate. (2) Intra-plate earthquakes 20-30 km inside the downgoing slab. They have fault mechanisms indicating extension along the dip of the slab. (3) Less frequent events that occur near the top of the downgoing slab and have thrust mechanisms with an almost horizontal E-W compressional axis. Three groups of events near 32.5°, 25.5° and 21°S were studied in detail. Depth and mechanisms were redetermined by *P*-wave modelling and relative locations were obtained by a master event technique. (27 refs.)

69123 Short review and recent results on microseisms. P.Bernard (Inst. de Phys. du Globe de Paris, Paris, France).
Geophys. Surv. (Netherlands), vol.5, no.4, p.395-407 (Feb. 1983).
This paper endeavours, mostly in a bibliographical manner, to show the place of meteorological microseisms among the whole of geophysics. Relations with swell are mentioned with their theoretical and practical consequences for the properties of both phenomena, and the work of members of the International Commissions on Microseisms is summarized, covering velocity and bearing of the waves, spectral analysis, relation with atmospheric circulation, and world-wide extension of these researches since the IGY. In a recent project, undecennial variation of yearly means of microseismic disturbance, the maximum of which often occurs 2-3 years after sunspot maxima, is investigated using data from several stations. Changes in the solar constant are suggested as the physical influence responsible, and new recording devices are proposed to follow on an absolute scale the future behaviour of such an index of atmospheric disturbances. (64 refs.)

69124 Reply to M. Berberian's comment on the paper, A. Mohajer-Ashjai and A.A. Nowroozi 'The Tabas earthquakes of September 16, 1978 in east central Iran', G.R.L. No. 9L0391. A.Mohajer-Ashjai (Atomic Energy Organization of Iran, Tehran, Iran), A.A.Nowroozi.
Geophys. Res. Lett. (USA), vol.10, no.3, p.199-202 (March 1983).
For original see ibid., vol.9, no.3, p.193-4 (1982). The Tabas earthquake of September 16, 1978, M=7.7, has been associated with extensive thrust faulting; there has been some confusion about the fault-length associated with this earthquake. At least 70 km of fresh surface faulting is associated with this earthquake together with several branches of secondary faulting. (15 refs.)

69125 Three dimensional velocity image of a barrier associated with a moderate Pyrenean earthquake. J.R.Grasso (Lab. de Geophys. Interne, IRIGM, Grenoble, France).
Geophys. Res. Lett. (USA), vol.10, no.3, p.229-32 (March 1983).
The prominent role of barriers is now well recognized in both the initialization and the extension of the earthquake rupture. The mapping of barriers is therefore important in understanding the physical processes by which earth-

quakes occur. The author inverts 800 P wave travel times from an aftershock sequence following a moderate earthquake ($m_b=5.1$) in the Pyrenean area (France) using a stochastic inverse technique to derive a three-dimensional velocity image of the structure. Two scales of imagery were carried out. Both scales reveal the presence of a high velocity contrast (+8%) at the eastern limit of the aftershock zone. This velocity anomaly corresponds to a geometric discontinuity in the trace of the major fault and can be mapped down to a depth of 8 km. (15 refs.)

69126 Crustal structure beneath Spain from deep seismic sounding experiments. E.Banda (Inst. of Geophys., ETH, Zurich, Switzerland), A.Udias, St.Mueller, J.Mezcua, M.Boloix, J.Gallart, A.Aparicio.
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.277-80 (April 1983).
Major tectonic units of Spain have been investigated by deep seismic sounding experiments since 1974 to determine crustal structures and to delineate their differences. These areas are the central part of the Hercynian Meseta, and the Alpine chains: the Betic Cordillera in the south, including the Balearic promontory and the Alboran Sea, and the Pyrenees in the north. The main features of the crust and the upper mantle along a NNE-SSW cross-section from the Pyrenees to the Alboran Sea are described. The crust under the Meseta is typical of Hercynian areas found elsewhere in Europe, with an average thickness of 31 km, whereas the two Alpine regions are characterized by very large lateral inhomogeneities, such as rapid thickening of the crust to 50 and 40 km under the Pyrenees and the Betics, respectively. The deep-reaching E-W-trending North Pyrenean fault has a throw of 10-15 km at the base of the crust. A P_n velocity of 8.1 km s^{-1} is found under the entire Iberian Peninsula. (17 refs.)

69127 Inhomogeneous structure of the Voronezh shield lithosphere from explosion seismology data. A.P.Tarkov, I.V.Basula (Geological Dept., Voronezh State Univ., Voronezh, USSR).
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.281-92 (April 1983).
Presents the results of a seismological investigation of the Voronezh shield. The use of industrial quarry blasts and telemetric arrays of the Taiga type for deep seismic sounding observations has enabled the Geophysical Research Group of the Voronezh State University to obtain complete and valid information concerning the deep structure of the shield. Seismic records of refracted and reflected P and S phases from the intracrustal and subcrustal discontinuities allowthe determination of independent and compatible velocity models $V_P(Z)$ and $V_S(Z)$. Analysis of the travel-time and amplitude curves derived from the deep seismic sounding data reveals a complex and inhomogeneous structure of the Voronezh shield lithosphere. The major discontinuities are found in the middle part of the consolidated crust. Several rather thick layers can be resolved, which are separated by first-order seismic boundaries. (23 refs.)

69128 Deep seismic reflection waves and structure of the crust from Dangxung to Yadong on the Xizang Plateau (Tibet). Teng Ji-Wen, Sun Ke-Zhong, Xiong Shao-Bai, Yin Zhou-Xun, Yao Hung, Chen Li-Fang (Inst. of Geophys., Acad. Sinica, China).
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.293-306 (April 1983).
The travel times, velocities and spectral distributions of reflected waves generated by underwater explosions in lakes on the Xizang Plateau are studied. The crustal structure on both sides of the Yarlung Zangbo River has been estimated by the inverse solution known as damped least squares. The depth of the Moho is 70-73 km in the region north of the Yarlung Zangbo River; the depth of the Moho in the southern region is 68-45 km. There is a low-velocity (~5.47 km s^{-1}) layer in the crust, and the crustal thickness decreases from north to south in the Xizang Plateau. (14 refs.)

69129 Crustal structure beneath the eastern part of the Coast Ranges (Diablo Range) of central California from explosion seismic and near earthquake data. P.Blumling, C.Prodehl (Geophys. Inst., Univ. Karlsruhe, Karlsruhe, Germany).
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.313-26 (April 1983).
Seismic refraction and near earthquake data of the US Geological Survey for central California have been compiled into record sections along profiles and interpreted in terms of crustal structure. The profiles are located northeast of the San Andreas fault of central California and run parallel to the general structures. For the explosion seismic line through the centre of the Diablo Range, an uppermost layer (Franciscan formation) with P velocities of 3.6-5.0 km s^{-1} decreases in thickness towards the northwest. The lower boundaries of layers with constant velocities of 5.75 and 6.8 km s^{-1} are found at almost constant depths of 12 and 21 km, respectively. Between 21 and 26 km depth a well-defined low-velocity zone appears. This zone is underlain by a layer 3-5 km thick with a velocity of 7.6 km s^{-1}. The upper-mantle velocity beneath the Moho at 29-30 km depth is 8.2 km s^{-1}. The velocity-depth distribution derived for the earthquake data is very similar to that found beneath the Diablo Range. (31 refs.)

69130 A crustal seismic reflection—refraction experiment across the subducted Pacific plate under Wellington, New Zealand. F.J.Davey, E.G.C.Smith (Geophys. Div., DSIR, Wellington, New Zealand).
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.327-33 (April 1983).
A strong seismic reflector occurs at a depth of ~20 km beneath Wellington. It has been suggested that this reflector may coincide with the interface between the lithosphere of the Indian plate and the underlying lithosphere of the Pacific plate which is currently being subducted at the Hikurangi Trough in the east and dips under North Island, New Zealand, to the west. It would be useful to define this interface from the Hikurangi Trough to the Marlborough Sounds where seismicity data indicate that the subducted plate bends down sharply. The measurements reported here were made along a profile ~50 km long from Palliser Bay to Cook Strait at a point just south of Makara on the west coast of southern North Island. (5 refs.)

69131 Modeling short-period crustal phases (P, Lg) for long-range refraction profiles. K.H.Olsen (Earth & Space Sci. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA), L.W.Braile, J.N.Stewart.
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.334-47 (April 1983).
The short-period seismic phases known as $\bar{P}$ and Lg are often recorded at distances of 200-1000 km on long-range refraction profiles. P and Lg propagate as multiply reflected compressional and shear waves in a crustal waveguide whose principal boundaries are the Moho and the free surface. Equivalently, they can be interpreted as the interference pattern produced by a superposition of higher-mode P, SV and SH waves propagating in a leaky waveguide. For compressional waves, the waveguide efficiency is a strong function of frequency and depends on the presence or absence of low-velocity layers within a few kilometers of the surface. Such low-velocity surface layers create constructive interference effects for upcoming P waves incident at near grazing angles at the free surface and lead to efficient $\bar{P}$ propagation. Several good examples of strong $\bar{P}$ phases can be found on long-range refraction profiles for the tectonically active western United States: the 550 km profile eastward from SHOAL to Delta, UT, is analyzed in this article. A modified reflectivity-method computer program is used to model crustal phases for the SHOAL-Delta profile. (16 refs.)

69132 Longshot experiments to study velocity anisotropy in the oceanic lithosphere of the northwestern Pacific. H.Shimamura (Geophys. Inst., Hokkaido Univ., Sapporo, Japan), T.Asada, K.Suyehiro, T.Yamada, H.Inatani.
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.348-62 (April 1983).
Several long-range explosion seismology experiments have been conducted in the northwestern Pacific basin, where one of the oldest oceanic lithospheres is postulated to exist. The lengths of the profiles ranged from 1000 to 1800 km, and the directions were chosen to provide wide azimuthal coverage. One of the aims of this series of experiments was to test the existence of velocity anisotropy on a large, regional scale. The results show that the oceanic lithosphere has anisotropy wherein the velocity changes by 4-7%. The anisotropy extends from a depth of at least 40 to 140 km beneath the sea bottom; however, the magnitude of the anisotropy may vary with depth. The azimuth of the maximum velocity is 150-160° clockwise from north, and coincides with the 'fossil' direction of spreading of the Pacific plate. The azimuth does not seem to depend on depth. The lithosphere is basically two-layered. (14 refs.)

69133 Studies of the continental crust by near-vertical reflection methods: a review. R.Meissner, E.Luschen, E.R.Fluh (Inst. fur Geophys., Univ. Kiel, Kiel, Germany).
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.363-76 (April 1983).
The development of near-vertical reflection methods for investigating the continental crust is strongly related to progress that has been made in seismic prospecting and in wide-angle observation in crustal refraction studies. Owing to the good structural resolution of near-vertical reflection methods, many details concerning first-order interfaces in the upper and lower crust have been established. The authors describe the upper and lower crust structural features that have been observed by these methods. (63 refs.)

69134 The use of seismic reflection profiles to probe the crystalline basement in Britain. D.J.Blundell (Chelsea Coll., Univ. of London, London, England).
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.377-81 (April 1983).
In an attempt to assess the feasibility of a future programme of seismic reflection profiling to investigate major structural features deep within the crust of Britain, existing commercial offshore data across shallow basement have been investigated together with lines on land, fired conventionally with explosives, in which record lengths have been extended to at least 12 s two-way time. Profiles crossing Lewisian basement, a granite batholith, and Caledonian and Variscan structures have been examined. The seismic information has been combined with gravity and magnetic surveys, bore-hole logs and surface geology to give self-consistent interpretational models. Features such as instrusive bodies and thrust faults can be discerned within the basement. These are clearly visible on the seismic record section obtained along the MOIST line, fired along the north coast of Scotland especially for deep reflections, and, for the first time, normal-incidence reflections from the Moho are clearly observed. (7 refs.)

69135 Earthquake dating: an application of carbon-14 atom counting. A.B.Tucker (Phys. Dept., San Jose State Univ., San Jose, CA, USA), W.Woefli, G.Bonani, M.Suter.
Science (USA), vol.219, no.4590, p.1320-1 (18 March 1983).
Milligram-sized specimens of detrital charcoal from soil layers associated with prehistoric earthquakes on the Wasatch fault in Utah have been dated by direct atom counting of carbon-14 with a tandem Van de Graaff accelerator. The measured ratios of carbon-14 to carbon-12 correspond to ages of 7800, 8800, and 9000 years with uncertainties of ±600 years. (7 refs.)

69136 I.S.C. mislocation of earthquakes in Iran and geometrical residuals. I.Asudeh (Dept. of Earth Sci., Univ. of Cambridge, Cambridge, England).
Tectonophysics (Netherlands), vol.95, no.1-2, p.61-74 (1983).
P-wave arrival-time data from earthquakes in the Zagros Fold Belt area of western Iran, recorded at as many as 20 local stations temporarily in operation during September 1976, are used to find errors in epicentre locations issued by the International Seismological Centre (ISC). Assuming that Zagros earthquakes are generally confined to the crust (Jackson and Fitch 1981), it was possible to obtain accurate epicentres for these earthquakes. It is shown that when inaccurate velocity models are used in earthquake locations, the geometry of the network of stations used induces a new type of travel-time residuals, called 'geometrical residuals' here, which will disappear if the velocity models are corrected. The geometrical residuals contain information about the correct velocity structure and appear in the routine epicentre locations issued by the ISC.

69137 Potential earthquake risk estimations by application of a simulation process. A.Shapira (Seismological Div., Inst. for Petroleum Res. & Geophys., Holon, Israel).
Tectonophysics (Netherlands), vol.95, no.1-2, p.75-89 (1983).
Potential earthquake risks are defined in terms of the annual probability of exceeding a peak ground acceleration level at the free surface of a site. Potential earthquake risks in Israel were estimated by Shapira (1981, 1982), by considering the apparent seismicity of the region during the last 145 years. A simulation process is applied in order to examine the reliability of previous estimations and to provide another general tool for earthquake risk evaluation. A relatively simple Monte-Carlo procedure was developed and is used for estimating, as an example, the potential earthquake risk in Jerusalem (Israel). The estimated probabilities obtained by the simulation procedure are, for all practical purposes, similar to the apparent probabilities previously determined by the author.

69138 A comparison of the estimate earthquake probabilities in the northeast Indian region. H.C.Goswami, S.K.Sarmah (Dept. of Environmental Sci., Gauhati Univ., Gauhati, India).
Tectonophysics (Netherlands), vol.95, no.1-2, p.91-9 (1983).
The probabilities of occurrence of different magnitude earthquakes are computed using conventional recurrence relation applying completeness test, Gumbel's Type I and Type III distributions of extreme values, and Tanh-fit theory to the available earthquake data for the northeast Indian region. Although there are differences in the results of the estimated return periods of different magnitudes by different methods, the study tends to indicate that the magnitude of the most probable largest annual earthquake is close to 6 and that the same for a 50 year period is 8 or greater.

Symposium on Probing the Earth's Lithosphere by Controlled Source Seismology .... See Entry 64583

An explanation for contradictory geodetic strain and fault plane solution data in western North America .... See Entry 69142

Can 'pure-path' models explain free oscillation data? .... See Entry 69144

Crustal structure of the northern Mississippi Embayment and a comparison with other continental rift zones .... See Entry 69153

Test of tectonic models by great circle Rayleigh waves .... See Entry 69163

Geodynamics and seismicity of the Pamir-Himalayas region ... See Entry 69167

Quaternary geology and neotectonics of the West flank of the northern Sangre de Cristo Mountains, south-central Colorado .... See Entry 69169

The role of seismic refraction data for studies of the origin and evolution of continental rifts .... See Entry 69186

Seismic contact transducer .... See Entry 69341

STKS symmetric three-component electrodynamic seismometer .... See Entry 69342

Multichannel seismographs with galvanometric recording .... See Entry 69343

N-052 engineering-seismic system .... See Entry 69344

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Deconvolution of seismograms by the autoregressive method ... See Entry 69365

Computer processing of vertical seismic profile data .... See Entry 69367

Synthetic body wave seismograms for laterally varying layered structures by the Gaussian beam method .... See Entry 69368

Relations between the acoustic response (5 kHz) and the lithologic character of sea floor .... See Entry 69378

Isolated sensor ocean bottom seismometer .... See Entry 69379

91.35 EARTH'S INTERIOR STRUCTURE AND PROPERTIES

69139 **Genesis of the Batinah melange above the Semail ophiolite, Oman.** A.H.F.Robertson (Grant Inst. of Geology, Edinburgh, Scotland), N.H.Woodcock.
J. Struct. Geol. (GB), vol.5, no.1, p.1-17 (1983).
The Batinah melange which overlies the late Cretaceous Semail ophiolite in the northern Oman Mountains comprises mostly sedimentary rocks of deep-water facies, alkalic lavas and intrusives, all of continental margin affinities, together with smaller volumes of Semail ophiolitic and metamorphic rocks. The detailed geology of this area is descributed in detail. The rock fracture and deformation features are also described. The authors argue that, during later Cretaceous emplacement over the Arabian margin, active fault corridors split the Semail slab and acted as conduits up which sub-ophiolite rocks were supplied to the ophiolite surface. There the rocks were redistribed by superficial processes. (26 refs.)

69140 **Strain and shape-fabric variations associated with ductile shear zones.** C.Simpson (Dept. of Geological Sci., Brown Univ., Providence, RI, USA).
J. Struct. Geol. (GB), vol.5, no.1, p.61-72 (1983).
The foliated and compositionally-bended granitic orthogneisses in the central core of the Maggia Nappe, a Lower Pennine basement nappe of the Central Swiss Alps, are shown to be the sheared equivalent of late-Hercynian age granitic intrusions. These ductile shear zones show mineral assemblages in amphibolite facies, are Alpine in age and form an anastomosing network enclosing remnant lozenge-shaped pods of relatively undeformed rock. The foliation developed within the shear zones concomitantly with a change in shape of quartz grain aggregates from initially equidimensional, through 'tear-drop' shapes, to ribbon-like aggregates. These shape changes occurred by intracrystalline glide together with intercrystalline slip on deformation-induced planar surfaces. (48 refs.)

69141 **Development of early composite cleavage in pelites from West Donegal.** A.W.Meneilly (Natural Environment Res. Council, Cambridge, England).
J. Struct. Geol. (GB), vol.5, no.1, p.83-97 (1983).
In the Portnoo-Rosbeg area of west Donegal the main penetrative cleavage, S_2, generally dips to the south with F_2 folds facing up to the north. In places the S_2 cleavage is cut by a gently SW-dipping crenulation cleavage (S_3) verging and facing south on the long limbs of F_2 folds. A series of structural domains have been mapped in which the relationship of s_2 and S_3 changes from cross-cutting at a large angle (Rosbeg domain) to the development of a composite $S_{2/3}$ cleavage (Portnoo domain). The relationship between the two phases and the composite cleavage was investigated by mapping out cleavages (megascopic scale), detailed mesoscopic field observations and on a microscopic scale using textural relationships to widespread post D_2-pre D_3 garnet porphyroblasts. (23 refs.)

69142 **An explanation for contradictory geodetic strain and fault plane solution data in western North America.** M.L.Sbar (Dept. of Geosci., Univ. of Arizona, Tucson, AZ, USA).
Geophys. Res. Lett. (USA), vol.10, no.3, p.177-80 (March 1983).
In a few areas of western North America the principal strain azimuths from geodetic strain measurements differ dramatically from the principal stress directions inferred from fault plane solutions of earthquakes. The reason for this difference may be related to the amount of strain measured by each technique. The strain relieved in an earthquake is about two orders of magnitude greater than that observed by geodetic measurements taken over approximately a seven year time span. Strain measurements may thus sense short-term fluctuations in strain, while earthquakes may average these short-term fluctuations responding to the total strain accumulated to produce a more reliable measure of the longer-term tectonic strain. (15 refs.)

69143 **Continental lithospheric thickness and deglaciation induced true polar wander.** W.R.Peltier, P.Wu (Dept. of Phys., Univ. of Toronto, Toronto, Ontario, Canada).
Geophys. Res. Lett. (USA), vol.10, no.3, p.181-4 (March 1983).
The secular drift of the Earth's rotation pole, which is evident in ILS data, is a memory of the planet of the last deglaciation event of the current ice age. In order to fit the observed rate and direction of drift with an Earth model whose viscosity profile is capable of reconciling the free air gravity and relative sea level data of postglacial rebound, requires a lithospheric thickness which is substantially in excess of that which might be considered an appropriate average thickness for the entire planet. This required thickness, which is greater than 250 km, is nevertheless in accord with independent estimates of the thickness of the continental lithosphere. (23 refs.)

69144 **Can 'pure-path' models explain free oscillation data?.** H.Kawakatsu (Dept. of Geophys., Stanford Univ., Stanford, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.3, p.186-9 (March 1983).
Several recently published regionalized models of the Earth's lateral heterogeneity obtained by 'pure-path' analysis are compared to free oscillation data of Masters et al. (1982). Among these models, Okal's (1977) model shows a strongly dominant pattern of angular order $l=2$ heterogeneity that is strikingly similar to Masters et al.'s data. This suggests that Okal's model may explain the free oscillation data as well as the 'transition-zone' model of Masters et al., and that shallow lateral heterogeneity may be responsible for the simple pattern of Masters et al. The apparent success of Okal's model suggests the importance of lateral heterogeneity within oceanic regions. The instability of 'pure-path' analysis is also demonstrated by spectral analysis of the lateral heterogeneities of different 'pure-path' models. (12 refs.)

69145 **Alteration of basaltic glass: mechanisms and significance for the oceanic crust-seawater budget.** H.Staudigel (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA), S.R.Hart.
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.337-50 (March 1983).
The authors study the geochemical process whereby glass is altered to palagonite by the action of seawater. The authors describe microprobe analyses of the glass and its alteration products. Trace element and Sr isotope measurements were also made. Since the geochemical fluxes during the alteration are high, the authors also evaluated the abundances of the most important secondary phases acting as sinks for elements liberated during glass alteration. (60 refs.)

69146 **Fixation of radionuclides in the ^{238}U decay series in the vicinity of mineralized zones. I. The Austatom Uranium Prospect, Northern Territory, Australia.** P.J.Shirvington (AAEC Res. Establ., Lucas Heights, NSW, Australia).
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.403-12 (March 1983).
The minimum age of a zone of secondary mineralization, located at the Austatom Prospect in the Alligator Rivers region of Australia, is estimated to be 3.6×10^5 y. This is derived from a geochronological model based on retarded leaching of ^{234}U with respect to ^{238}U and on ratios within the ore of these members of the ^{238}U decay series. Although kaolinite is a dominant mineral in the weathered schist-host-rocks, retarded dissolution of ^{234}U occurs only in the presence of the clay minerals illite and montmorillonite. In their absence the reverse occurs. A model is proposed to explain the results. Ratios of ^{230}Th to ^{238}U indicate that the mineralization has probably remained stationary within the weathered schist for at least 1 to 20×10^5 y. Future use of clay minerals as buffers in radioactive waste repositories is supported by the excellent long-term retention obtained for oxidized uranium. (33 refs.)

69147 **A method of calculating quartz solubilities in aqueous sodium chloride solutions.** R.O.Fournier (US Geological Survey, Menlo Park, CA, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.579-86 (March 1983).
The aqueous silica species that form when quartz dissolves in water or saline solutions are hydrated. Therefore, the amount of quartz that will dissolve at a given temperature is influenced by the prevailing activity of water. Using a standard state in which there are 1000 g of water (55.51 moles) per 1000 cm^3 of solution allows activity of water in a NaCl solution at high temperature to be closely approximated by the effective density of water, ρ_e, in that solution, i.e. the product of the density of the NaCl solution times the weight fraction of water in the solution, corrected for the amount of water strongly bound to aqueous silica and Na^+ as water of hydration. Generally, the hydration of water correction is negligible. The solubility of quartz in pure water is well known over a large temperature-pressure range. An empirical formula expresses that solubility in terms of temperature and density of water and thus takes care of activity coefficient and pressure-effect terms. Solubilities of quartz in NaCl solutions can be calculated by using that equation and substituting ρ_e for the density of pure water. Calculated and experimentally determined quartz solubilities in NaCl solutions show excellent agreement when the experiments were carried out in non-reactive platinum, gold, or gold plus titanium containers. (42 refs.)

69148 **Calculation of amorphous silica solubilities at 25° to 300°C and apparent cation hydration numbers in aqueous salt solutions using the concept of effective density of water.** R.O.Fournier, W.L.Marshall (US Geological Survey, Menlo Park, CA, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.587-96 (March 1983).
The solubility of amorphous silica in aqueous salt solutions at 25° to 300°C can be calculated using information on its solubility in pure water and a model in which the activity of water in the salt solution is defined to equal the effective density, ρ_e, of 'free' water in that solution. At temperatures of 100°C and above, ρ_e closely equals the product of the density of the solution times the weight fraction of water in the solution. At 25°C, a correction parameter must be applied to ρ_e that incorporates a term called the apparent cation hydration number, h. Because of the many assumptions and other uncertainties involved in determining values of h, by the model used here, the reported numbers are not necessarily real hydration numbers even though they do agree with some published values determined by activity and diffusion methods. Whether or not h is a real hydration number, it would appear to be useful in its inclusion within a more extensive activity coefficient term that describes the departure of silica solubilities in concentrated salt solutions from expected behavior according to the model presented here. Both NaCl and Na_2SO_4 solutions are studied. (34 refs.)

69149 The role of CO_2 in the chemical modification of deep continental crust. W.E.Glassley (Dept. of Geology, Middlebury Coll., Middlebury, VT, USA).
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.597-616 (March 1983).
Compositional differences between granulite facies rocks and equivalent amphibolite facies rocks and the observation of CO_2-rich fluid inclusions in granulites, have led to the suggestion that CO_2 must play a role in modifying the composition of deep continental crust. How CO_2 effects this change has remained unclear. Using the thermodynamic properties of aqueous ions in a fluid of evolving CO_2/H_2O ratio, it is possible to model the incongruent dissolution of feldspars under conditions appropriate for granulite facies metamorphism. The results demonstrate that dissolution will be strongly enhanced at high CO_2/H_2O ratios, with ion solubilities being $Na^+ > K^+ \gg Ca^{++}$. This enhancement is compatible with the reported composition contrasts between granulite and amphibolite facies rock, but requires large fluid volumes. To test the dissolution model, a detailed field and petrologic study was conducted in a well exposed granulite facies terrane in West Greenland. Strong correlation between fluid composition and bulk rock chemistry can be documented. (87 refs.)

69150 Elemental composition of two cumulate rocks. A.Naeem (Dept. of Phys., King Saud Univ., Riyadh, Saudi Arabia), A.A.Almohandis.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1604-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Two cumulate rock samples K-185, K-250 from the Kapalagulu intrusion, W Tanzania, were analyzed using X-ray fluorescence (XRF), wet chemical and neutron activation analysis (NAA) techniques. Major element oxides were determined by XRF and wet chemical methods, while the concentration of trace elements were measured by NAA, using high resolution Ge(Li) detector, mini-computer-based data acquisition system and an off-line computer. The percentage of major oxides and sixteen trace elements are reported. It is found that Cr, Ni, and Co are highly concentrated in K-250 while Sc, and most of the major elements are more concentrated in K-185. The variation of major and trace elements in these two samples are discussed. (6 refs.)

69151 Origin of Hawaiian tholeiite and alkalic basalt. C.-Y.Chen, F.A.Frey (Dept. of Earth & Planetary Sci., MIT, Cambridge, MA, USA).
Nature (GB), vol.302, no.5911, p.785-9 (28 April 1983).
Haleakala Volcano consists of a tholeiitic basalt shield overlain by alkalic lavas. As a function of decreasing age, La/Ce, Ba/La, Nb/La, Rb/Sr and $^{143}Nd.^{144}Nd$ increase but Sm/Nd and $^{87}Sr/^{86}Sr$ decrease. Inverse correlations between these isotopic ratios and their respective parent/daughter abundance ratios are consistent with mixing of melts derived from an enriched mantle composition with melts formed by <1% melting of a mid-ocean ridge basalt source. (44 refs.)

69152 Combined Sr-O isotope relationships and petrogensis of Andean volcanics of South America. B.Deruelle (Dept. of Earth Sci., Univ. of Yaounde, Yaounde, Cameroun), R.S.Harmon, S.Moorbath.
Nature (GB), vol.302, no.5911, p.814-16 (28 April 1983).
Presents the first combined Sr- and O-isotope study of the southern volcanic zone in Chile (crustal thickness <40 km) and of the southern part of the central volcanic zone (CVZ) in the borderlands of Bolivia, Chile and Argentina (crustal thickness ~60-70 km). Only one of 13 volcanic centres studied (Lascar) exhibits a correlated increase in both ^{87}Sr and ^{18}O parallel with the basalt-andesite-rhyolite compositional change, indicative of contamination by upper crust through a fractional crystallization-assimilation mechanism. The other centres of the CVZ, for which there is an overall Sr-O correlation, document the variable contamination of mantle-derived magmas at depth in the lower crust which had been thickened by Mesozoic and earlier plutonism. (22 refs.)

69153 Crustal structure of the northern Mississippi Embayment and a comparison with other continental rift zones. W.D.Mooney, M.C.Andrews, A.Ginzburg, D.A.Peters, R.M.Hamilton (US Geological Survey, Menlo Park, CA, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.327-48 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Previous geological and geophysical investigations have suggested that the Mississippi Embayment is the site of a Late Precambrian continental rift that was reactivated in the Mesozoic. New information on the deep structure of the northern Mississippi Embayment, gained through an extensive seismic refraction survey, supports a rifting hypothesis. The data indicate that the crust of the Mississippi Embayment may be characterized by six primary layers. The presence and configuration of a low-velocity layer provides evidence for rifting in the Mississippi Embayment. The confirmation and delineation of a 7.3 km/s layer, identified in previous studies, implies that the lower crust has been altered by injection of mantle material. The results indicate that this layer reaches a maximum thickness in the north-central Embayment and thins gradually to the southeast and northwest, and more rapidly to the southwest along the axis of the graben. The apparent doming of the 7.3 km/s layer in the north-central Embayment suggests that rifting may be the result of a triple junction located in the Reelfoot Basin area. The crustal structure of the Mississippi Embayment is compared to other continental rifts.

69154 Crustal structure of rifted continental margins: geological constraints from the Proterozoic rocks of the Canadian Shield. R.M.Easton (Dept. of Earth Sci., Memorial Univ., St. John's, Canada).
Tectonophysics (Netherlands), vol.94, no.1-4, p.371-90 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Rifts associated with possible Proterozoic continental margins and embryonic ocean basins are characterized by an association of tholeiitic volcanics that have chemical characteristics of MORBs, flysch-like sedimentary rocks and extensive gabbro sill swarms comagmatitic with the volcanic rocks. These rifts are similar in stratigraphy and crustal structure to modern rifts such as the Gulf of California. The similarity of these Proterozoic rifts to modern rifts indicate that the process(es) of rifting on the Earth may have been persistent for the past 2.0 Ga. A variety of other Proterozoic rifts are also present in the Canadian Shield, and workers in the Precambrian must examine each rift on an individual basis in order to determine the tectonic setting of the rift being studied.

69155 A numerical model of coupled subcontinental and oceanic convection. U.Christensen (Inst. fur Meteorologie und Geophys., Univ. Frankfurt, Frankfurt, Germany).
Tectonophysics (Netherlands), vol.95, no.1-2, p.1-23 (1983).
At least two different types of convection should exist in the Earth's mantle: a large scale flow which is revealed by the creation and subduction of oceanic crust, and a circulation of unknown scale under the continents, which does not approach the surface. The effects of these coexisting and interacting modes on mantle dynamics and thermal regime are investigated by means of a finite element model system of two adjacent cells which are coupled thermally and mechanically at their interface. An a-priori viscosity distribution is applied in such a way that the surface layer of the longer cell can move with almost uniform velocity, while it is immobile on the shorter cell.

Symposium on Probing the Earth's Lithosphere by Controlled Source Seismology .... See Entry 64583

Conference on the Processes of Planetary Rifting .... See Entry 64585

Uranium-lead radiometric age determinations of naturally occurring U(VI) minerals: application to radwaste storage .... See Entry 65384

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Inhomogeneous structure of the Voronezh shield lithosphere from explosion seismology data .... See Entry 69127

Deep seismic reflection waves and structure of the crust from Dangxung to Yadong on the Xizang Plateau (Tibet) .... See Entry 69128

Crustal structure beneath the eastern part of the Coast Ranges (Diablo Range) of central California from explosion seismic and near earthquake data .... See Entry 69129

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Longshot experiments to study velocity anisotropy in the oceanic lithosphere of the northwestern Pacific .... See Entry 69132

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The use of seismic reflection profiles to probe the crystalline basement in Britain .... See Entry 69134

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Satellite orbit perturbations due to the deforming potential of centrifugal forces ....See Entry 69473

Monopole heat ....See Entry 69495

91.40 VOLCANOLOGY

69156 On the intermittency and crystallisation mechanisms of sub-seafloor magma chambers. C.R.B.Lister (School of Oceanography, Univ. of Washington, Seattle, WA, USA).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.351-65 (May 1983).
The conventional view of a magma chamber being an essentially permanent feature of a fast-spreading ridge is not compatible with the physics of either oceanic crustal structure or internal magma convection. There is clear-cut thermal evidence that magma chambers at spreading centres can only be present intermittently. Yet the pervasiveness of cumulate gabbroic outcrops in ophiolite suites show that the chambers, when present, are of considerable lateral extent. The problem now is to discover how a ridge-crest can make room for a large magma chamber in a time short enough for it to develop without being crystallised before it can form. (33 refs.)

Origin of Hawaiian tholeiite and alkalic basalt ....See Entry 69151

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A feldspar-liquid geothermometer ....See Entry 69201

Atmospheric turbidity over Africa—disturbed by the El Chichon eruption? ....See Entry 69321

91.45 PHYSICS OF PLATE TECTONICS

69157 Analysis of faulting in porous sandstones. A.Aydin (Dept. of Geosci., Purdue Univ., West Lafayette, IN, USA), A.M.Johnson.
J. Struct. Geol. (GB), vol.5, no.1, p.19-31 (1983).
Faults in porous sandstones occur in three forms: deformation bands about 1 mm thick and tens of m long and across which offsets are a few mm; zones of deformation bands constituted of many closely spaced deformation bands across which offsets are a few cm or dm; and slip surfaces, that is, distinct surfaces within zones of deformation bands across which offsets are a few m to a few tens of m. Deformation bands represent highly localized deformation; analogous localization within a field of homogeneous deformation is theoretically possible in elastic materials with certain ranges of constitutive parameters. Crushing and consolidation of sandstone within a band cause the material there to become stiffer than the surrounding porous sandstone. A zone of deformation bands behaves mesoscopically much as stiff inclusion in a soft matrix. According to the constitutive model assumed to investigate the formation of deformation bands, an instability can develop, and strain increments within the zone of deformation bands can become boundlessly large when the far-field stresses reach critical values. This instability is here associated with the formation of slip surfaces. (28 refs.)

69158 Displacement features associated with fault zones: a comparison between observed examples and experimental models. J.F.Gamond (Equipe de Recherches, CNRS, Grenoble, France).
J. Struct. Geol. (GB), vol.5, no.1, p.33-45 (1983).
Fault zones commonly consist of discontinuous surfaces or are composed of different kinds of en echelon fractures (tension cracks, R or P-type fractures) which give the brittle shear zone a width. Translation along these faults and related features can occur by sliding on the elementary planes and/or by solution/deposition processes with opening of transtension zones and possible dilation of the shear zone. In order to understand how fault planes develop and to investigate the mechanical conditions corresponding to natural configurations, displacement along an analogue fault model was examined under conditions of direct shear. The experimental fracture patterns were then compared with the natural features. The structural elements of certain faults created by testing, and showing transpresssion and transtension zones, were found to be similar to natural domino structures bounded by elementary shears, and could be compared with computed situations. (22 refs.)

69159 Interpretation of fracture and physiographic patterns in Alberta, Canada. A.E.Scheidegger (Abteilung fur Geophys., Tech. Univ. of Vienna, Vienna, Austria).
J. Struct. Geol. (GB), vol.5, no.1, p.53-9 (1983).
Thousands of linear elements (joint traces, river trends and photolinears) have been identified and statistically analysed in the Province of Alberta, Canada, from the US border to the Fort McMurray area. A statistical evaluation was performed on the data by fitting Dimroth-Watson distributions to groups of them. It is suggested that the joints represent shear surfaces formed in a neotectonic stress field whose maximum compression is oriented normal to the front of the Rocky Mountains, at least in the vicinity of that range. Further to the northeast, the stress trajectories swing to E-W and N-S directions. The photolineaments are features of uncertain origin and age. (12 refs.)

69160 Large-scale gravity profiles across subducted plates. M.Rabinowicz, B.Lago, M.Souriau (CNES/GRGS, Toulouse, France).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.325-49 (May 1983).
The mean gravity profiles, across Central and South America and Eurasia, in the direction normal to the subduction zone are deduced from the Gem 10B gravity model. They have a typical shape: a maximum close to the trench, a negative slope towards the interior of the plate over a 3000 km wide distance, usually followed by a local maximum. It is found that large convective cells driven by the heat sink of the sinking slab have an associated gravity signal having such a typical shape. A detailed comparison between observed and theoretical data supports this point of view and thus constrains the possible structure of the convective flow under these plates. (42 refs.)

69161 Palaeomagnetic data about southern Tibet (Xizang). I. The Cretaceous formations of the Lhasa block. M.Westphal (Inst. de Phys. du Globe de Strasbourg, Strasbourg, France), J.-P.Pozzi, Yao Xiu Zhou, Li Shen Xing, Xian Yao Chen.
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.507-21 (May 1983).
A palaeomagnetic study of Middle to Late Cretaceous redbeds from Linzhou basin (Lhasa block), north of the Yarlung Zangbo suture zone, gives a stable palaeomagnetic direction of magnetisation with a positive fold-test: six sites, 57 samples, $D=333°$, $I=38°$, $k=78$, $\alpha_{95}=8°$, pole 64°N, 348°E. The authors discuss the problem of a possible remagnetisation but consider that this direction of magnetisation gives a good approximation for the palaeolatitude of the Lhasa block during Middle to Late Cretaceous times. Results from more recent Tibetan formations are also presented. An interpretation is proposed whereby the Lhasa block, which was a part of Asia in the Early Cretaceous, has undergone first a southward motion accompanied by an anticlockwise rotation and then, after the Palaeocene, a northward motion under the constraint of the colliding India. (16 refs.)

69162 Correction to: A thin viscous sheet model for continental deformation. P.England (Dept. of Geological Sci., Harvard Univ., Cambridge, MA, USA), D.McKenzie.
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.523-32 (May 1983).
The governing equation derived by England & McKenzie (1982) for the deformation of a thin viscous shell contains an error. The authors give the correct derivation and correct those figures where the change makes a visible difference. The correct results differ quantitatively from those of England & McKenzie but their conclusions are not affected. (1 ref.)

69163 Test of tectonic models by great circle Rayleigh waves. A.Souriau, M.Souriau (Centre Nat. d'Etudes Spatiales, Toulouse, France).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.533-51 (May 1983).
A large set of published great circle Rayleigh wave phase velocities in the period range 125-350 s is used to compare three recent tectonic models (Okal, 1977; Leveque, 1979, 1980; Jordan, 1978, 1981). Prior to any regionalisation, the symmetry property of the great circle integrals is used to obtain a lower limit of the signal/noise ratio in the data. A standard regression method is applied for computing the 'pure path' velocities and the model efficiency is derived from a variance analysis. The three models have nearly the same efficiency for explaining the short-period data ($T\sim125$ s). Between 200 and 300 s, the higher performance of Okal's model indicates that it is important to separate the subduction zones from the other orogenic zones. The anomalous ellipticity values deduced directly from great circle data are partly explained by a coupling between tectonics and ellipticity. (30 refs.)

69164 Tectonic evolution of the southwest Indian Ocean since the mid-Cretaceous: plate motions and stability of the pole of Antarctica/Africa for at least 80 Myr. R.L.Fisher (Scripps Instn. of Oceanography, Univ. of California, San Diego, CA, USA), J.G.Sclater.
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.553-76 (May 1983).
Presents a detailed topographic chart of the ridge and bordering region between 35°E and 55°E, in addition to a compilation of all the published magnetic anomalies in the same area and also magnetic data recorded in 1978 by R/V Melville of the Scripps Institution of Oceanography on Leg 8 of Expedition Indomed. These data are supplemented by recent unpublished Atlantis II magnetic lines. Bathymetry and magnetic patterns are used with the relocated earthquake epicentres to determine the tectonic elements of the Southwest Indian Ridge between 35°E and 55°E. Older magnetic lineations either side of the ridge axis are identified south of Madagascar and north of Crozet. A history of the Southwest Indian Ocean from the Late Cretaceous (anomaly 34, 80 Ma) to the present is developed. An estimate of the reconstructed position of the African, Antarctic and Indian continents suggests possible positions in the original configuration of Gondwanaland. (36 refs.)

69165 Fragmentation and assembly of the continents, mid-Carboniferous to present. E.Irving (Pacific Geosci. Centre, Sidney, BC, Canada).
Geophys. Surv. (Netherlands), vol.5, no.4, p.299-333 (Feb. 1983).
Eighteen maps showing the motions of the major continents following the break-up of Wegener's Pangaea in the Early to Mid-Jurassic are presented. Palaeolatitudes are determined palaeomagnetically, palaeolongitudes mainly from sea-floor spreading evidence. The break-up commences with the opening of the southern North Atlantic in the mid-Jurassic and its extension north and south in the Cretaceous and Cenozoic. Concurrently the northern continents move northwards away from the southern continents (Gondwana) and a continuous east-west seaway is formed between them in the Cretaceous. Successive fragmentation of continents then created the Arctic, Indian and Antarctic Oceans. Five maps showing the disposition of land in the Permian are also given. The Permian maps show Gondwana situated further east than in the Pangaea configuration of Wegener. There are severe problems in constructing palaeogeographical maps for the Triassic and none are presented. (79 refs.)

69166 Guyots of the Dutton Ridge at the Bonon/Mariana Trench juncture as shown by multi-beam surveys. N.C.Smoot (NSTL Station, US Naval Oceanographic Office, Bay St. Louis, MS, USA).
J. Geol. (USA), vol.91, no.2, p.211-20 (March 1983).
Very accurate bathymetric data for five guyots from the newly named Dutton Ridge are presented along with that of two associated nearby guyots. These new data are based on US Naval Oceanographic Office swath mapping by the SASS multi-beam sonar system (Glenn 1970). The Dutton Ridge is a

major east-west trending feature that intersects the junction of the Bonin and Mariana Trenches. Its trend parallels that of the Michelson Ridge, which lies further to the North at the intersection of the Izu and Bonin trenches. The author suggests that the Dutton Ridge formed as a volcanic plateau at the extinct triple junction of the Phoenix, Farallon, and Pacific Plates. This once-continuous plateau was then fractured and faulted to produce the present group of guyots and ridges. Later volcanism may have altered its morphology. Subsequently, the ridge passively rode along on the Pacific Plate to its present location where it may be jamming the trench juncture, as indicated by a lack of seismic activity at that spot. (26 refs.)

69167 Geodynamics and seismicity of the Pamir-Himalayas region. B.S.Volvovsky (Soviet Geophys. Committee, Moscow, USSR), I.S.Volvovsky, N.Sh.Kambarov.
Phys. Earth & Planet. Inter. (Netherlands), vol.31, no.4, p.307-12 (April 1983).
Deep seismic sounding studies allow an important peculiarity of the deep structure of the Pamir-Himalayas region to be established: the thickness of the Earth's crust is almost twice as large here as on the stable plates. The absence of any evidence for doubling of crustal thickness provides grounds for rejecting the hypothesis of subduction of the rigid Hindustan plate under the geosynclinal folded constructions of the Punjab syntaxis of the Himalayas. Several faults reflect the dynamics and conditions of formation of deep layers of the lithosphere. The Fore Himalayan and Major Himalayan faults are the boundaries between different structural facial zones. The band of greatest thickness of crust extends within the zone of greatest thickness of the asthenospheric layer; a deep minimum in the Bouguer anomalies (−550 mGal) corresponds to this zone. Seismicity of the lithosphere of the Pamir-Himalayas region is caused by geodynamic processes manifested in the higher lithospheric layers by block displacements of the Earth's crust (mostly uplifts), and in the lower parts by shifts of the steeply inclined mantle blocks (the Pamir-Hindukush seismic focal zone). (5 refs.)

69168 Dating of movements along thrusts and faults in the Himalaya. H.S.Saini (Birbal Sahni Inst. of Palaeobotany, Lucknow, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.539-44 (Nov. 1982). [received: April 1983]
Radiometric dating of movements along the MCT (Vaikrita Thrust), two local but deep seated thrusts and the Sumdoh Fault Zone bordering the Kinnar Kailas Granite in the Baspa and Satluj valleys, NE Himachal Himalaya, has been attempted for the first time by fission track method. Garnet and apatite fission track ages suggest the age of the latest phase of movements around 14 and 7 m.y. respectively along the MCT and Sumdoh Fault. The vertical uplift rate along them were 1.1 mm/year from 14 to 7 m.y. and 0.6 mm/year from 7 m.y. to recent geologic past respectively, as against the value 0.036 mm/year during the period from 210 to 17 m.y. in the undisturbed area. (11 refs.)

69169 Quaternary geology and neotectonics of the West flank of the northern Sangre de Cristo Mountains, south-central Colorado. J.McCalpin (Dept. of Geology, Utah State Univ., Logan, UT, USA).
Q. Colorado Sch. Mines (USA), vol.77, no.3, p.V-XIII, 1-97 (July 1982). [received: April 1983]
The Quaternary history of these mountains was dominated by four or five episodes of glaciation. Alluvial fans, moraines and glacial outwash features were studied. The Quaternary faulting of the Sangre de Cristo Fault Zone and Villa Grove Fault Zone in the San Luis Valley is described. The magnitude of Quaternary earthquakes is estimated from observations of the fault displacements. The Quaternary earthquake occurrence is compared to the lack of present day seismicity. (107 refs.)

69170 Mechanism of graben formation—the wedge subsidence hypothesis. M.H.P.Bott, D.P.Mithen (Dept. of Geological Sci., Univ. of Durham, Durham, England).
Tectonophysics (Netherlands), vol.94, no.1-4, p.11-22 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Isostatic subsidence of a downward narrowing wedge of the brittle upper crust bounded by normal faults is shown to provide a viable mechanism of graben formation. Energy balance calculations indicate that the mechanism depends on the occurrence of substantial deviatoric tension, but it requires a much smaller extension than the lithospheric stretching hypothesis. For the mechanism to be effective, a relatively high geothermal gradient is required to allow ductile flow of the lower crust, and the friction on the faults must be much less than that appropriate to dry rock. The amount of subsidence also depends on the narrowness of the graben, the strength of the tensile stress field in the upper crust, and sediment loading. Preliminary finite element analysis is carried out to model the subsidence process. It is suggested that the tension causing the majority of the present day rift systems is produced by the topographical loading and isostatic body forces related to the associated uparching.

69171 Rifts and swells: geophysical constraints on causality. S.T.Crough (Dept. of Geosci., Purdue Univ., West Lafayette, IN, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.23-37 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Analyses are developed to examine whether rifting can generate broad topographic swells and whether swells formed by lithospheric thinning can generate rifts. Although swells can be supported by deep lithospheric cracks filled with low-density intrusions, observed topography and gravity constrain how this might occur. Single deep dikes apparently cannot explain the width of swells, the low-gravity gradients on swell flanks, or the lack of a large negative free-air anomaly over swell crests. If swells are supported by deep cracks, there must be numerous narrow dikes distributed over the full breadth of each swell. Comparing the hydrostatic pressure of various columns of lithosphere to that of an ocean ridge crest suggests the conditions under which a swell might spread apart.

69172 Mechanisms of active and passive rifting. D.L.Turcotte, S.H.Emerman (Dept. of Geological Sci., Cornell Univ., Ithaca, NY, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.39-50 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Obtains two solutions relating to the alternative active and passive hypotheses for continental rifting. Active rifting assumes the impingement of a mantle plume on the base of the continental lithosphere. The authors determine the rate of lithosphere thinning due to this impingement and conclude that it takes 50-75 million years to thin the continental lithosphere to the base of the crust; the long length of time required appears to rule out this lithospheric erosion mechanism as a viable mechanism for complete lithospheric thinning. The authors suggest that diapiric penetration is the mechanism by which hot mantle rock reaches the base of the continental crust of a rift and have obtained values for the tensional stresses generated by the diapiric penetration of hot asthenospheric rock into the lithosphere. The stress levels are obtained as functions of lithospheric and crustal thinning factors.

69173 Mechanisms of uplift preceding rifting. J.-C.Mareschal (School of Geophys. Sci., Georgia Inst. of Technol., Atlanta, GA, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.51-66 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
The feasibility of three mechanisms, that have been proposed to account for the uplifts and heat flow anomalies which might precede rifting, is examined. The conductive heating, following an increase in the heat flux at the base of the lithosphere, could result in large scale uplifts on a time scale of 10^8 years. A pulse of additional heat flow could induce a more rapid uplift but not the surface heat flow anomaly which is always delayed. The advection of heat by magma intrusion into the lithosphere could also produce the uplift and heat flow anomaly. The complete replacement of the lithosphere by the rise of a diapir of lighter and hotter asthenospheric material modelled numerically. The model indicates that the rise of the asthenospheric diapir can take place in a very short time and produce the surface uplift and the crustal thinning observed in rift systems.

69174 Convective thinning of the lithosphere: a mechanism for rifting and mid-plate volcanism on Earth, Venus, and Mars. T.Spohn, G.Schubert (Inst. fur Meteorologie und Geophys., J.W. Goethe Univ., Frankfurt, Germany).
Tectonophysics (Netherlands), vol.94, no.1-4, p.67-90 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Thinning of the Earth's lithosphere by heat advected to its base is a possible mechanism for continental rifting and continental and oceanic mid-plate volcanism. It might also account for continental rifting-like processes and volcanism on Venus and Mars. The Earth's continental lithosphere can be thinned to the crust in a few tens of million years by heat advected at a rate of 5-10 times the normal basal heat flux. This much heat is easily carried to the lithosphere by mantle plumes. The continent is not required to rest over the mantle hot spot but may move at tens of millimeters per year. For large increases in asthenospheric heat flow, the lithosphere is almost thinned to the crust before any significant change in surface heat flow occurs. The oceanic lithosphere can be thinned to the crust in less than 10 million years if the heat advection is at a rate around five or more times the basal heat flow into 100 Ma old lithosphere.

69175 Mechanical aspects of continental rifting. H.J.Neugebauer (Inst. fur Geophys., Tech. Univ. Clausthal, Clausthal-Zellerfeld, Germany).
Tectonophysics (Netherlands), vol.94, no.1-4, p.91-108 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Continental rifting is associated with characteristic processes such as crustal extension and vertical movements observed on the surface, and deep-seated phenomena such as lithospheric thinning and upwelling of mantle material. These characteristics are expressed in a variety of geophysical anomalies; increased heat flow, low long wavelength Bouguer gravity with relative gravity high along the rift, delayed body-wave travel times, as well as by volcanic activity with various depth of magma source. The author discusses the concepts of rifting by either lateral or vertical transmission of mechanical energy on the basis of several quantitative numerical models. Mantle diapir models are discussed in detail with reference to the initiation and diapir phases of development, and the induced stress regime. The initiation and development of elongated mantle diapirs is the only concept that explains the majority of phenomena associated with continental rifting.

69176 Submarine rifting at mid-ocean ridges. G.T.Jarvis (Dept. of Geology, Univ. of Toronto, Toronto, Ontario, Canada).
Tectonophysics (Netherlands), vol.94, no.1-4, p.109-22 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
An analytical model for the formation of mid-ocean ridges is presented in which the central rift zone is interpreted as a belt of localized extension of width $2W$ centred on the ridge axis. Upwelling of the asthenosphere occurs passively below the zone of extension at the rate required to conserve mass. At distances greater than W from the ridge axis the lithospheric plates move at a uniform horizontal velocity u_0. The model is thermally and mechanically consistent and predicts the surface heat flow and topography across the rift zone plus the vertical thermal structure and the thickness of the lithosphere below the zone of extension. Measurements of ridge heat flow and topography can be used to constrain estimates of the width of the zone of intrusion.

69177 Hotspot tracks and the early rifting of the Atlantic. W.J.Morgan (Dept. of Geological & Geophys. Sci., Princeton Univ., Princeton, NJ, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.123-9 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Many hotspot tracks appear to become the locus of later rifting, as though the heat of the hotspot weakens the lithosphere and tens of millions of years later the continents are split along these weakened lines. A modern day analog of a possible future rift is the Snake River Plain, where the North American continent is being 'pre-weakened' by the Yellowstone hotspot track. This conclusion is based on reconstructions of the motions of the continents over hotspots for the past 200 million years. The relative motions of the plates are determined from magnetic anomaly isochrons in the oceans and the motion of one plate is chosen ad hoc to best fit the motions of the plates over the hotspots. However, once the motion of this one plate is chosen, the motions of all the other plates are prescribed by the relative motion constraints. In addition to the correlation between the predicted tracks and sites of later continental breakup, exposed continental shields correlate with the tracks.

69178 Mechanism of subsidence of ancient cratonic rift basins. R.F.DeRito (Dept. of Geological Sci., State Univ. of New York, Amherst, NY, USA), F.A.Cozzarelli, D.S.Hodge.
Tectonophysics (Netherlands), vol.94, no.1-4, p.141-68 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Cratonic basins commonly occur over ancient rift zones. These inactive rift basins are recognizable by a positive linear Bouguer gravity anomaly that may correspond to the axial gravity high found in modern rift valleys. Many of these basins undergo discrete periods of increased subsidence rates, or reactivations, long after the mass excess responsible for the linear gravity high was emplaced. Furthermore, the reactivation of many cratonic basins occurs simultaneously with large-scale compressional tectonics. It is suggested that the driving force for subsidence is the isostatically uncompensated ancient mass excess. The subsidence of these basins is modelled by a lithospheric flexure model with a nonlinear Maxwell viscoelastic rheology. Solutions to this model indicate that basins may experience a low subsidence rate throughout geologic time. The subsidence of a basin will stop only when isostatic compensation of the mass excess is achieved. Reactivation by a world-wide increase in heat flow is suggested as a possible mechanism for the synchroneity of basin subsidence throughout a continent.

69179 Phenomena of pulsation tectonics related to the breakup of the eastern North American continental margin. R.E.Sheridan (Dept. of Geology, Univ. of Delaware, Newark, DE, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.169-85 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
New data from the recent IPOD drilling of DSDP Site 534 in the Blake-Bahama Basin give a definite age for the spreading-center shift involved in the breakup of the North American Atlantic margin. A basal Callovian age (~155 m.y.) is determined for the Blake Spur magnetic anomaly marking this spreading-center shift that signals the birth of the modern North Atlantic Ocean. An implication of this age for the Blake Spur event is that very high spreading rates are now required for the Jurassic outer magnetic quiet zone along the North American margin. This association of a relatively high spreading rate with a magnetic quiet zone implies a link between the processes controlling plate spreading, which are in the upper mantle, and the processes controlling the magnetic field, which are in the outer core. A theory of pulsation tectonics involving the cyclic eruption of plumes of hot mantle material from the lowermost mantle could explain the correlation. Plumes carry heat away from the core-mantle boundary and later reach the asthenosphere and lithosphere to induce faster spreading. Rifting of passive margins may be controlled by the more fundamental global processes described by the theory of pulsation tectonics.

69180 Gravity study of the Central African Rift System: a model of continental disruption. I. The Ngaoundere and Abu Gabra rifts. S.E.Browne, J.D.Fairhead (Dept. of Earth Sci., Univ. of Leeds, Leeds, England).
Tectonophysics (Netherlands), vol.94, no.1-4, p.187-203 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
A regional compilation of published and unpublished gravity data for Central Africa is presented and reveals the presence of a major rift system, the Central African Rift System. It is proposed that the junction area between the Ngaoundere and Abu Gabra rift arms in Western Sudan forms an incipient intraplate, triple-junction with the as yet unfractured, but domally uplifted and volcanically active, Darfur swell. It is only the Darfur swell that shows any similarities to the uplift and rift history of East Africa. The other two rifts arms are considered to be structurally similar to the early stages of passive margin development and thus reflect more closely the initial processes of continental fragmentation than the structures associated with rifting in East Africa.

69181 Gravity study of the Central African Rift System: a model of continental disruption. II. The Darfur domal uplift and associated Cainozoic volcanism. P.M.Bermingham, J.D.Fairhead, G.W.Stuart (Dept. of Earth Sci., Univ. of Leeds, Leeds, England).
Tectonophysics (Netherlands), vol.94, no.1-4, p.205-22 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
For pt.I see ibid., vol.94, no.1-4, p.205-22 (1983). Gravity studies of the Darfur uplift, Western Sudan, show it to be associated with a circular negative Bouguer anomaly, 50 mGal in amplitude and 700 km across. A three-dimensional model interpretation of the Darfur anomaly, using constraints deduced from geophysical studies of similar but more evolved Kenya and Ethiopia domes, suggests either a low-density laccolithic body at mid-lithospheric depth (~60 km) or a thinned lithosphere with emplacement at high level of low-density asthenospheric material. The regional setting of the Darfur uplift is described. The data suggest that extensional tectonics and passive rifting, resulting in the subsiding sedimentary rift basins associated with the Ngaoundere, Abu Gabra, Red Sea and Gulf of Aden rifts, are more typical of the early stage development of passive continental margins than the active domal uplift and development of rifted features associated with the Darfur, Kenya and Ethiopia domes.

69182 Baikal rift: active or passive?—comparison of the Baikal and Kenya rift zones. N.A.Logatchev, Y.A.Zorin, V.A.Rogozhina (Inst. of the Earth's Crust, Acad. of Sci., Irkutsk, USSR).
Tectonophysics (Netherlands), vol.94, no.1-4, p.223-40 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
The comparison of geological and geophysical data from the Kenya and Baikal rift zones permits one to consider the formation of these zones to be associated with the development of wide asthenospheric upwellings beneath them. In this sense, both rifts are active. Differences between them in amounts of volcanics and geological features may be explained by a higher degree of partial melting of asthenospheric material beneath the Kenya rift.

69183 Processes of planetary rifting as seen in the rifting and break up of Africa. R.W.Girdler (School of Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Tectonophysics (Netherlands), vol.94, no.1-4, p.241-52 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
The problem of the way in which rifting and thinning of the lithosphere occurs is discussed. In Africa, a sequence of rift processes is seen from incipient rifting in the south, to block faulting (basin and range) in Tanzania, to full rift valley development in Kenya with volcanism increasing northwards through Kenya and Ethiopia. The sequence is accompanied by increasing thinning of the lithosphere northwards. Arguments are presented which strongly suggest that the faulting precedes the lithospheric thinning. These lead to the abandonment of the simple stretching model in which faulting follows thinning and its replacement by a model in which the 'thinning' is a consequence of rifting. Horizontal stresses first cause brittle fractures which allow hot material to rise from the asthenosphere and the eventual development of large asthenoliths.

69184 The distribution and implications of heat flow from the Gregory Rift in Kenya. K.Crane, S.O'Connell (Lamont-Doherty Geological Obs., Columbia Univ., Palisades, NY, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.253-75 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Data from geothermal mapping along the Kenyan Gregory Rift zone using ground and aerial infrared techniques indicate that an average of 11-30 MW/km are advectively emitted along the rift. The bulk of the advected heat is lost through the central part of the Kenyan dome. Two other secondary geothermal sites are at the northern and southern limits of the rift adjacent to rift bifurcation zones. Active thermal fields occur only 1/7 as frequently as rift volcanoes. Geothermal spacing could be controlled by the length of the heat source at the lithosphere-upper mantle boundary, the thickness of the crust and the length of the rift segment between major structural breaks.

69185 Constraints on rift thermal processes from heat flow and uplift. P.Morgan (Lunar & Planetary Inst., Houston, TX, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.277-98 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Heat is of fundamental importance in the genesis of continental rift zones. Heat flow data are available from the Baikal, Basin and Range (North America), East African, Rhine and Rio Grande rift systems, and most of the data indicate high heat flow. Data from the essentially non-volcanic sections of the East African rift system indicate normal to low heat flow, however. With the exception of the Basin and Range system, and parts of the Rio Grande system, the high heat flow appears to be restricted to the grabens, and is not measured on the broad domal or plateau uplifts associated with the rift systems. The uplifts associated with rifts typically are on the order of 1 to 2 km, with diameters of a few hundred kilometers or more, and the duration of the main phase of uplift is on the order of a few tens of million years, or less. These broad uplifts probably result from thermal changes in the lithosphere-asthenosphere system. Two thermal models of the lithosphere are developed for comparison with the heat flow and uplift data.

69186 The role of seismic refraction data for studies of the origin and evolution of continental rifts. K.H.Olsen (Los Alamos Nat. Lab., Los Alamos, NM, USA).
Tectonophysics (Netherlands), vol.94, no.1-4, p.349-70 (1983). (Conference on the Processes of Planetary Rifting, St. Helena, CA, USA, 3-5 Dec. 1981).
Universal attributes of continental rift systems are crustal extension with associated asthenospheric upwelling or modification of the mantle beneath the rift axis. Continental rifting is thus greatly controlled, if not driven, by geodynamic processes in the lower lithosphere. Seismic refraction profiling is a technique for obtaining high-resolution data on structures, seismic velocities, and petrologic conditions in the deep crust and upper mantle. Status of presently available seismic refraction data in four major Cenozoic continental rift systems is reviewed in the light of extent of coverage in area and depth, reliability of velocity measurements, and outstanding structural and geodynamical problems that remain unanswered for each system. Evidence of crustal thinning, anomalous mantle at the Moho, as well as shallow and midcrustal velocity anomalies exist in all four examples. The Rhinegraben is the best constrained system from the point of view of seismic structure models.

69187 Paleomagnetism of the Bonin Islands and its tectonic significance. K.Kodama (Dept. of Geology, Kochi Univ., Kochi, Japan), B.H.Keating, C.E.Helsley.
Tectonophysics (Netherlands), vol.95, no.1-2, p.25-42 (1983).
Paleomagnetic samples were collected from six of the Bonin Islands located on the northeastern margin (27°N, 142°E) of the Philippine Sea. These volcanic islands are of Eocene age. Both lava flows and dikes were collected at each of 34 sites with Chichi-jima the largest island being sampled most extensively. Mean directions of the 27 sites on Chichi-jima are divisible into two groups showing antipolar relationships at the 95% confidence level. The low inclinations and deflected declinations of the Bonin Islands are interpreted as being due to tectonic rotation. Since the northward drift and clockwise rotation are consistent with the tectonic movement inferred for the West Philippine Basin by previous studies, the Bonin Islands appear to have been part of the basin before opening of the Shikoku and Parece Vela basins during the Miocene.

69188 Stress-induced fracturing and magnetic susceptibility anisotropy in the Bleiberg-Kreuth mining region, Austria. J.S.Rathore, H.J.Mauritsch (Dept. of Geophys. & Planetary Phys., Univ. of Newcastle upon Tyne, Newcastle upon Tyne, England).
Tectonophysics (Netherlands), vol.95, no.1-2, p.157-71 (1983).
A magnetic fabric study involving rock samples from above and below the ground was conducted in the mining region of Bleiberg-Kreuth, in Carinthia, Austria. Detailed magnetic fabric and fracture analyses show that the fractures and shear planes are related to the tectonically-produced magnetic fabric. Using this relationship, it is possible to delineate a time dependent tectonic evolution of the study region: the Bleiberg-Kreuth area underwent at least two phases of major compression with a period of relaxation in between. The shear angle and the angle of internal friction in rocks are important parameters for predicting fracture failure. It is shown how 'in-situ' evaluation of these parameters can be made using the magnetic susceptibility anisotropy. Determination of the degree of deformation within different rock types and directions of movement along shear planes also are demonstrated.

69189 Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning. M.Oluic (Industroprojekt, Zagreb, Yugoslavia), D.Cvijanovic.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.567-74 vol.1
The area of central and western part of Yugoslavia is analyzed on multispectral Landsat images. A great number of geomorphological and tectonic elements are registered, of which the most important are faults and ring structures. Many of them are seen for the first time. The data are compared with the results of exploration of seismic activity, geothermal and mineral occurrences, and ore occurences and layers, respectively. A relation is established between tectonic elements registered on the satellite images and the seismic activity registered so far and/or the known geothermal occurrences and ore layers. (7 refs.)

Conference on the Processes of Planetary Rifting .... See Entry 64585

Palaeolatitudes from DSDP Leg 73 sediment cores: implications for the apparent polar wander path for Africa during the late Mesozoic and Cenozoic ....See Entry 69094

Palaeomagnetism of the Proterozoic Zig-Zag Dal Basalt and the Midsommerso dolerites, eastern North Greenland ....See Entry 69095

Pre-23 magnetic anomalies between Jan Mayen and Greenland-Senja fracture zones in the Norwegian Sea ....See Entry 69105

Seamount magnetism in the Ionian Sea, eastern Mediterranean ....See Entry 69106

Magnetotelluric results opposing magma origin of crustal conductors in the Rio Grande rift ....See Entry 69109

Bilateral propagation of a spontaneous two-dimensional anti-plane shear crack under the influence of cohesion ....See Entry 69121

Complex distribution of large thrust and normal fault earthquakes in the Chilean subduction zone ....See Entry 69122

A crustal seismic reflection—refraction experiment across the subducted Pacific plate under Wellington, New Zealand ....See Entry 69130

Genesis of the Batinah melange above the Semail ophiolite, Oman ....See Entry 69139

Strain and shape-fabric variations associated with ductile shear zones ....See Entry 69140

Development of early composite cleavage in pelites from West Donegal ....See Entry 69141

An explanation for contradictory geodetic strain and fault plane solution data in western North America ....See Entry 69142

Continental lithospheric thickness and deglaciation induced true polar wander .. ..See Entry 69143

Crustal structure of the northern Mississippi Embayment and a comparison with other continental rift zones ....See Entry 69153

Crustal structure of rifted continental margins: geological constraints from the Proterozoic rocks of the Canadian Shield ....See Entry 69154

On the intermittency and crystallisation mechanisms of sub-seafloor magma chambers ....See Entry 69156

Stress and displacement distributions around pyrite grains ......See Entry 69192

Origin of the inverted metamorphism of the Lower Himalayas, central Nepal ....See Entry 69203

91.50 MARINE GEOLOGY AND GEOPHYSICS

69190 **Side-scan sonar mapping and computer-aided interpretation in the Santa Barbara Channel, California.** B.P.Luyendyk, E.J.Hajic, D.S.Simonett (Dept. of Geological Sci., Univ. of California, Santa Barbara, CA, USA).
Mar. Geophys. Res. (Netherlands), vol.5, no.4, p.365-88 (1983).
The authors experimented with digital processing of side scan sonar data taken in a 14 sq-km area of continental shelf offshore Southern California. The data were FM tape recorded during the survey and digitized and processed later in the laboratory. The digital image processing included both image correction and image enhancement. Geometric corrections were applied to correct for image distortions due to variable ship position and speed and sonar slant range. Enhancements that were tried included contrast stretching, band-pass filtering, image restoration (inverse filtering) and various edge enhancements such as density slicing and standard deviation filters. Interpretive procedures were also attempted and included digital mosaicking, stereoscopic viewing, and false-color display. The most effective processing was geometric correction combined with contrast stretching. Mosaicking proved difficult due to imprecise navigation (±50 m), but was very effective in increasing the understanding of the geologic structure in the survey area. (20 refs.)

69191 **East Pacific Rise near 13°N: geology of new hydrothermal fields.** R.Hekinian (Centre Oceanologique de Bretagne, Brest, France), M.Fevrier, F.Avedik, P.Cambon, J.L.Charlou, H.D.Needham, J.Raillard, J.Boulegue, L.Merlivat, A.Moinet, S.Manganini, J.Lange.
Science (USA), vol.219, no.4590, p.1321-4 (18 March 1983).
Abundant massive sulfide deposits are present at the crest of the East Pacific Rise near 13° North, where the opening rate is about 12 centimeters per year. Large manganese and helium-3 anomalies in seawater samples, evidence of intense present-day activity of hydrothermal springs, indicate that sulfides are still being produced along this segment of the rise. Massive sulfides also occur on adjacent off-axis seamounts. (13 refs.)

Diffusion of neptunyl(V)- and pertechnetate ions in marine sediments ....See Entry 65385

Predictions of radionuclide migration rates for a subseabed repository ....See Entry 65387

Mercury and chlorinated hydrocarbons in sediments from the Bay of Naples and adjacent marine areas ....See Entry 68904

Can 'pure-path' models explain free oscillation data? ....See Entry 69144

Alteration of basaltic glass: mechanisms and significance for the oceanic crust-seawater budget ....See Entry 69145

Tectonic evolution of the southwest Indian Ocean since the mid-Cretaceous: plate motions and stability of the pole of Antarctica/Africa for at least 80 Myr ....See Entry 69164

Guyots of the Dutton Ridge at the Bonon/Mariana Trench juncture as shown by multi-beam surveys ....See Entry 69166

91.60 PHYSICAL PROPERTIES OF ROCKS AND MINERALS

69192 **Stress and displacement distributions around pyrite grains.** S.O.Selkman (Boliden Mineral AB, Grangesberg, Sweden).
J. Struct. Geol. (GB), vol.5, no.1, p.47-52 (1983).
Photomicrographs from two sulfide-mineralized areas in Scandinavia show fragments of pyrite in a relatively homogeneous ground mass. At the extremities of the fragments, quartz segregations are common. In order to understand the stress and displacement in the development of these mineral segregations, the finite element method has been used. Models have been constructed in order to simulate angular fragments or crystals in an incompetent ground mass, which have been subjected to a differential pressure. Several models have been deformed iteratively, simulating viscous behaviour. The results indicate that the magnitude of deformation depends on the viscosity contrast, the magnitude of external pressure and the orientation of the inclusion. The stress distribution is governed by the viscosity contrast and the form of the inclusion. The tensile stress areas in the models are comparable with the areas of mineral segregation in the samples. (19 refs.)

69193 **A dislocation model for the aragonite$\rightleftharpoons$calcite transition.** P.Gillet, M.Madon (Inst. de Phys. du Globe, Lab. de Phys. et Mecanique des Materiaux Terrestres, Paris, France).
Bull. Mineral. (France), vol.105, no.6, p.590-7 (1982). In French.
A dislocation model for aragonite-calcite transition is suggested. A dislocation splitting in the calcite basal plane (0001) and aragonite basal plane (001), whose first partial is dragging a stacking fault, is responsible for the transition (or for the nucleation stage). This mechanism accounts for experimentally observed topotactic relations. (23 refs.)

69194 **Microwave properties of saturated reservoirs.** J.N.Lange (Dept. of Phys., Oklahoma State Univ., Stillwater, OK, USA).
Geophysics (USA), vol.48, no.3, p.367-75 (March 1983).
Dielectric properties of saturated, porous geologic materials reflect the large difference in dielectric constant ϵ of typical saturating fluids such as water ($\epsilon=78$) or oil and gas ($\epsilon=1$-3). The deconvolution of in-situ dielectric properties of saturated porous materials into the component parts requires a detailed model of the composite material. Defining aspects of this model in the microwave frequency regime is the primary purpose of this investigation. A model is examined in which the dielectric constant of the composite is equal to the sum of the dielectric constants of the components weighted by the volume fraction occupied by each. That model is compared to measurements at microwave frequencies made on systems consisting of glass beads, quartz, or sand saturated with chlorobenzene, 1,2-dichloroethane, methanol, or air, and find satisfactory agreement. When water is the saturant an interaction between water and the solid matrix has an important effect on the composite dielectric constant. (7 refs.)

69195 **On the theory of depositional remanent magnetization in sedimentary rocks.** V.P.Shcherbakov, V.V.Shcherbakova (Inst. of Phys. of the Earth, Moscow, USSR).
Geophys. Surv. (Netherlands), vol.5, no.4, p.369-80 (Feb. 1983).
The effects of various factors such as thermal agitation, coagulation, anisotropy of susceptibility, and shape irregularity on the alignment of magnetic carrier grains during the process of acquisition of depositional remanent magnetization in sedimentary rocks is discussed. (17 refs.)

69196 **The effect of strain heterogeneity on graphical strain analysis methods.** P.E.Holm (Dept. of Geology, Univ. of Windsor, Windsor, Ontario, Canada).
Tectonophysics (Netherlands), vol.95, no.1-2, p.101-10 (1983).
The most frequently used graphical strain analysis methods have been derived based on the assumption of homogeneous strain for the sample size investigated. In view of the heterogeneity of strain generally displayed by naturally deformed rocks on all scales, it is important to determine what effect varying degrees of strain heterogeneity have on these methods. An oolitic limestone was deformed at various strain rates and temperatures in order to achieve the desired variation by altering the relative contributions of intercrystalline and intracrystalline deformation mechanisms. Coefficients of determination for the best fit line to plots of the long vs. short axes of the deformed ooids were obtained and compared to the coefficient from a simulated homogeneous deformation of the same limestone. The samples were subsequently analyzed by the graphical strain analysis methods proposed by Dunnet (1969) and Elliott (1970). The reduction in fluctuation of long axis orientation of strain markers that occurs during constant volume deformation allows reasonable average values of the strain to be obtained even when the degree of strain heterogeneity is high.

69197 **Faulting of rocks in three-dimensional strain fields. I. Failure of rocks in polyaxial, servo-control experiments.** Z.Reches, J.H.Dieterich (Dept. of Appl. Math., Weizmann Inst. of Sci., Rehovot, Israel).
Tectonophysics (Netherlands), vol.95, no.1-2, p.111-32 (1983).
The dependence of the number of sets of faults and their orientation on the intermediate strain axis is investigated through polyaxial tests, and theoretical analysis. Cubic samples of Berea sandstone, Sierra-White and Westerly granites, and Candoro and Solnhofen limestones were loaded on their three pairs of faces by three independent, mutually perpendicular presses at room temperature. Two of the presses were servo-controlled and applied constant displacement rates throughout the experiment. Most samples display three or four sets of faults in orthorhombic symmetry. These faults form in several yielding events that follow a state of elastic deformation. In many experiments, the maximum and the intermediate compressive stresses interchange orientations during the yielding events, where the corresponding strains are constant. The final stage of most experiments is characterized by slip along the faults.

69198 **Faulting of rocks in three-dimensional strain fields. II. Theoretical analysis.** Z.Reches (Dept. of Appl. Math., Weizmann Inst. of Sci., Rehovot, Israel).
Tectonophysics (Netherlands), vol.95, no.1-2, p.133-56 (1983).
For pt.I see ibid., vol.95, no.1-2, p.111-32 (1983). The model for the faulting of rocks in a three-dimensional strain field is derived. It is assumed that the strain applied on a rock is accommodated by slip along faults. It is shown that four sets of faults in orthorhombic symmetry are required to accommodate general, three-dimensional deformation. It is further assumed that the preferred faults, namely, those which are most likely to slip, require the minimum stress difference and minimum dissipation. The orientations of these theoretically preferred faults are derived, and are compared with the experimental results of Part I (Reches and Dieterich, 1983). Charts of the preferred faults predicted by the present model are given.

69199 **Microscopic mechanisms of magnetic rock forming.** V.A.Shashkanov, V.P.Shcherbakov, V.V.Metallova, I.N.Petrov, K.A.Stabrovskii.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.30-4 (Feb. 1983). In Russian.
The nature of metastable states of thin ferromagnetic grains and ways of converting them into the ground stable state are discussed. The energetics of the transition between the two-domain metastable state and one-domain stable state of a magnetite particle is considered theoretically. (5 refs.)

69200 **The effect of magnetostatic interaction on the magnetization of the ensemble of ferromagnetic mineral single domain particles.** M.A.Fedotova, V.A.Shashkanov.
Vestn. Leningr. Univ. Fiz. & Khim. (USSR), no.1, p.100-2 (Feb. 1983). In Russian.
The effect of magnetostatic interaction on magnetic properties of rocks is investigated. Equations for total and remanent magnetization have been derived in the case of strong magnetostatic interaction between single domain ferromagnetic particles. From them expressions for J_{rs}, Q_{rs} and x have been found. (4 refs.)

Iron-enriched basalt for containment of nuclear wastes ....See Entry 65361

Site characterisation for field radionuclide migration studies in Climax granite ....See Entry 65376

A natural analogue for storage of radwaste in crystalline rocks ....See Entry 65380

Zirconolites from Sri Lanka, South Africa and Brazil ....See Entry 65382

Study of polyhalite from the WIPP site, New Mexico ....See Entry 65383

Uranium-lead radiometric age determinations of naturally occurring U(VI) minerals: application to radwaste storage ....See Entry 65384

Degradation of rocks, through cracking caused by differential thermal expansion, in relation to nuclear waste repositories ....See Entry 65395

Strontium-basalt reactions under nuclear waste repository conditions ....See Entry 65399

Chemical, physical and engineering characterization of candidate backfill clays and clay admixtures for a nuclear waste respository. I ....See Entry 65402

Influence of irradiation with gamma-quanta and beam of accelerated electrons on the sorption parameters of clay minerals of the montmorillonite group [radioactive waste] ....See Entry 65436

Computations of temperature profiles in the medium/low-level waste cement and in the rock salt surrounding the disposal cavern ....See Entry 65467

Viscosity of some glassy minerals ....See Entry 67260

Analysis of faulting in porous sandstones ....See Entry 69157

Stress-induced fracturing and magnetic susceptibility anisotropy in the Bleiberg-Kreuth mining region, Austria ....See Entry 69188

A feldspar-liquid geothermometer ....See Entry 69201

Electron microscopy of minerals ....See Entry 69334

91.65 GEOPHYSICAL ASPECTS OF GEOLOGY, MINERALOGY AND PETROLOGY

69201 A feldspar-liquid geothermometer. M.P.Smith (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
Geophys. Res. Lett. (USA), vol.10, no.3, p.193-5 (March 1983).
An expression that can be use to accurately calculate one atmosphere equilibrium temperatures from the compositions of coexisting feldspars and liquids was derived from experimentally studied natural systems and a wide range of simple systems. This expression is a superior predictor of temperature compared with other feldspar-liquid geothermometers. (61 refs.)

69202 Electron microscope studies of minerals: phase boundaries in an extremely slowly cooled clinopyroxene (augite). E.S.Crawford, J.A.Folkes, J.O.Williams (Edward Davies, Chem. Labs., Univ. Coll. of Wales, Aberystwyth, Wales), A.C.Barnicoat, M.J.O'Hara.
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.21-30 (8 May 1983).
High resolution electron microscopy has been used to study the nature of exsolution lamellae that developed during extremely slow and prolonged cooling and depressurization of an aluminium rich augite (high Ca clinopyroxene) taken from a layer of garnet-augite rich gneiss that outcrops on the north side of Scourie Bay, Sutherland, northwest Scotland. These sets of lamellae, which probably formed mainly during the middle of this evolution, were identified as amphibole, pigeonite and hypersthene. Observation of these forms enabled the relation between the phases and the cooling history of the rock to be established. (26 refs.)

69203 Origin of the inverted metamorphism of the Lower Himalayas, central Nepal. K.Arita (Dept. of Geology & Mineralogy, Hokkaido Univ., Sapporo, Japan).
Tectonophysics (Netherlands), vol.95, no.1-2, p.43-60 (1983).
The southern slope of the central Nepal Himalayas is divided geologically by the Main Central Thrust zone into the underlying Midland metasediment zone (Lower Himalayas) in the south and the overlying Himalayan gneiss zone (Higher Himalayas) in the north. The mineral composition and paragenesis of the rocks in the present area indicate an inverted metamorphism from the Midland metasediment to the Main Central Thrust zones, that is, the metamorphic grade of the Midland metasediment zone increases upward toward the thrust zone from the chlorite to the biotite zones of the greenschist facies, and the greenschist-amphibolite transitional zone is attained in the thrust zone. It is concluded that the Himalayan gneisses suffered a polymetamorphism. The younger metamorphism resulted in a retrograde metamorphism of the Himalayan gneisses together with the above-mentioned inverted metamorphism and a anatectic melting in depth. This was caused by shear heating due to the thrust movement along the Main Central Thrust zone during the Alpine tectonism.

69204 The development and application of a geological simulation model. M.G.Foley, G.M.Petrie (Pacific Northwest Lab., Richland, WA, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.288-90, vol.12
Describes the Geological Simulation Model developed under the Assessment of Effectiveness of Geologic Isolation Systems project at the Pacific Northwest Laboratory for the Department of Energy. It is a quasi-deterministic process-response model which simulates the development of the geologic and hydrologic systems of a groundwater basin for a million years into the future. Effects of natural processes on the ground-water hydrologic systems are modeled principally by rate equations. The combined effects and synergistic interactions of different processes are approximated by linear superposition of their effects during discrete time intervals in a stepwise-integration approach. (no refs.)

69205 Geologic observations of the northern boundary of the Caribbean Plate across Central America as seen by Seasat and SIR-A. P.Rebillard, T.Dixon, T.Farr (Jet Propulsion Lab., Pasadena, CA, USA).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.593-9 vol.1
A mosaic of four digitally correlated Seasat synthetic aperture radar images (rev 759) over Central America covers the northwestern Caribbean Plate boundary. The radar data extend from the Amatique Bay (Golfo de Honduras) in the northeast to the Pacific Ocean (Puenta Remedios) in the southwest. Space Shuttle Imaging Radar (SIR-A) data-take 18 overlaps the main part of the Seasat mosaic. SIR-A data permit more observations over the Central American Cordillera, where strong layover limited the amount of information obtained by Seasat. The radar coverage delineates the major strik-slip faults of the region (Cuilco-Chixoy-Polochic, Motagua and Jocotan) which have acted as the Caribbean-Americas plate boundary. It also discriminates volcanic terranes related to subduction of the Cocos Plate under the Caribbean Plate. (4 refs.)

The use of ^{222}Rn as a flow path monitor for studies of radionuclide transport in fissures .... See Entry 65374

Spectroscopic properties of transition elements in glasses of geological interest .... See Entry 68274

Three dimensional velocity image of a barrier associated with a moderate Pyrenean earthquake .... See Entry 69125

A method of calculating quartz solubilities in aqueous sodium chloride solutions .... See Entry 69147

Calculation of amorphous silica solubilities at 25° to 300°C and apparent cation hydration numbers in aqueous salt solutions using the concept of effective density of water .... See Entry 69148

Elemental composition of two cumulate rocks .... See Entry 69150

Crustal structure of rifted continental margins: geological constraints from the Proterozoic rocks of the Canadian Shield .... See Entry 69154

Mechanism of graben formation—the wedge subsidence hypothesis .... See Entry 69170

East Pacific Rise near 13°N: geology of new hydrothermal fields .... See Entry 69191

A dislocation model for the aragonite$\rightleftharpoons$calcite transition .... See Entry 69193

Electron microscopy of minerals .... See Entry 69334

Density distribution of the flux of delayed fission neutrons in water .... See Entry 69386

91.90 OTHER TOPICS IN SOLID EARTH GEOPHYSICS

69206 Acoustic fluidization [rock slides]. H.J.Melosh (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA).
Am. Sci. (USA), vol.71, no.2, p.158-65 (March-April 1983).
Can sound waves explain why dry rock debris appears to flow like a fluid in some energetic geologic events? The authors describe how this process can explain the observed low angle flows of large-scale rockslides. This process can also explain some of the observed features of meteorite craters. (27 refs.)

69207 The tempo of geomorphological change: evidence from southeastern Australia. R.W.Young (Dept. of Geography, Univ. of Wollongong, Wollongong, Australia).
J. Geol. (USA), vol.91, no.2, p.221-30 (March 1983).
A revised denudational chronology based on K-Ar dating of basalts for much of southeastern Australia shows that many major topographic features are far older than was previously realized. Some upland surfaces originated in the Mesozoic and others in the Early Tertiary; in some areas the last major uplift and onset of canyon cutting occurred prior to the Mid-Oligocene. Apart from the slow headward extension of canyons and localized high level stripping, much of the region had taken on approximately its present-day form by the Mid-Miocene. Paradoxically, however, none of the mechanisms that have been proposed to explain the survival of paleoforms hold. These instances may well be typical of large parts of the interior of tectonic plates, and a revision of widely held estimates of modal rates of denudation seems required. (43 refs.)

69208 Gas respiration of Earth. E.V.Borodzich, A.N.Eremeev, I.N.Yanitskii.
Priroda (USSR), no.2, p.18-27 (1983). In Russian.
The phenomenon of the Earth's gas respiration (the flow of gases deep inside the Earth which sometimes emerge violently, such as nitrogen, hydrogen or methane) is studied. An attempt is made to isolate the areas of the Earth in which this phenomenon emerges on the surface by measuring the distribution of helium concentrations in underground water. A brief outline of the study of natural gases is given with a detailed account of the INGEM-1 membrane-type high-sensitivity water-helium photographic device. The dangers inherent in deep drilling (particularly in the gas-oil industry) are discussed with special reference to anomalously high formation pressures. Some of the consequences of the discoveries made to date in this field are assessed as well as possible future developments. (14 refs.) *L.M.H.*

69209 Interpretability of linear phenomena on Seasat-1 imagery in the western coastal zone of Belgium in relation to the azimuthal and range resolutions. H.Dufourmont (Lab. for Regional Geography & Landscape Studies, State Univ. of Ghent, Ghent, Belgium).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.249-53 vol.1
The visual interpretability of linear features on SEASAT imagery is checked by means of comparison of variables two by two. The orientation of the flightline seems to influence the detectability of lines on the image. This assessment harms strongly the visual interpretability of linear features. (no refs.)

69210 Analysis of a multisensor image data set of south San Rafael Swell, Utah. D.L.Evans (Jet Propulsion Lab., Pasadena, CA, USA).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.255-9 vol.1
A Shuttle Imaging Radar (SIR-A) Image of the southern portion of the San Rafael Swell in Utah has been digitized and registered to coregistered Landsat, Seasat, and HCMM thermal inertia images. The addition of the SIR-A image to the registered data set improves rock type discrimination in both qualitative and quantitative analyses. Sedimentary units can be separated in a combined SIR-A/Seasat image that cannot be seen in either image alone. Discriminant Analyses show that the classification accuracy is improved with addition of the SIR-A image to Landsat images. (6 refs.)

69211 Seasat/SIR-A digital registration over Algeria. P.Rebillard, C.Elachi, M.Naraghi, J.Soha, W.Stromberg (Jet Propulsion Lab., Pasadena, CA, USA).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.271-6 vol.1
Seasat Synthetic Aperture Radar (SAR) and Shuttle Imaging Radar (SIR-A) data over northeastern Algeria have been compared and studied using digital registration. Preliminary results of this work show that: (1) both radars delineate in the same way the same features on the ground, (2) the Seasat image shows a strong difference between the Chott Melrhir and its environment, not seen in the same way by SIR-A, and (3) SIR-A data enhance more details on the floor of the Chotts, presumably due to the look angle or due to flooding conditions which may have occurred prior to the SIR-A experiment (November 12-14, 1981). (6 refs.)

69212 Use of SLAR lateral radar and Landsat satellites in geomorphspedological surveys carried out in the Venezuelan Amazon. M.Pouyllau (Domaine Univ., Talence, France).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.289-300 vol.1 In French.
For the 1:250000 scale geomorphic pedological survey of the Venezuelan Amazon, both side looking airborne radar SLAR stereoscopic images and ranges, and Landsat imagery have been used by the authors. The preliminary interpretations of the SLAR images have been completed with field surveys and at large and small scales and extrapolations on 1 square degree. The cartographic boundary adjustments have been performed using Landsat imagery. The multitemporal (space-craft) and multidimensional (radar) vectors association has permitted a previous soil and geomorphic estimation on about 13 millions hectares. The author presents the first results and the methodology used. (15 refs.)

69213 Remote sensing methods for geological investigations in the USSR to date and in future. V.B.Komarov (Lab. of Airborne Methods, Moscow, USSR).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.503-11 vol.1
Data obtained by various remote sensors installed on aircraft or space vehicles are applied in the USSR to all investigations related to the study and utilization of natural resources and to geological mapping and mineral exploration, in particular. Images obtained in the visible, infrared and radiowave ranges of the electromagnetic spectrum are broadly used for this purpose. In order to enhance informative features of the imagers, different methods of photographic transformation are elaborated, which greatly facilitate the interpretation process. Algorithms and programmes of computer-based processing of remote sensing data are currently being elaborated. (7 refs.)

69214 Use of SPOT simulations for geological studies. Comparison with aerial photographs and Landsat images example: Camares area-Massif central-France. G.Delpont, G.Weecksteen (Bur. de Recherches Geologiques et Minieres, Orleans, France).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.515-22 vol.1 In French.
A comparison between the interpretation of a SPOT simulation (1/13000), aerial photographs (1/60000) and Landsat images (1/50000), in the Camares area (France) is discussed. The influence of the hyperstereoscopic effect is discussed. (no refs.)

69215 Phenomenon of transparency in the metamorphic cover of a tin-tungsten leucogranite (Zamora, Spain). Comparison between multi spectral data processing and ground truth. B.Marconnet, C.Gagny (Univ. de Nancy, Vandoeuvre-les-Nancy, France), P.Leymarie, J.M.Monget.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.523-31 vol.1 In French.
The remote sensing, applied to a tin-tungsten mining district, has shown a phenomenon of granitic transparency in its metamorphic cover. This result is obtained from a comparative study between the anomalic area and a check area with similar morphological characteristics, by field work and multispectral data processing. (8 refs.)

69216 Comparison between spectral signatures of Landsat and SPOT on the sandstone outcrops of the Bandiagara Plateau-Mali. C.Bardinet (CTAMN-ENSMP, Valbonne, France), J.M.Monget, J.P.Blanck, J.Tricart.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.543-55 vol.1 In French.
The new information brought by the refined resolution of SPOT is used in the structural analysis of the Bandiagara Plateau. This formation is Cambro-Ordovician sandstone. The area surveyed by the SPOT simulation zuns perpendicular to the North rim of the plateau east of Dombara along a 10×20 km strip going from Saoura-Ambile down to the Dombara-Sinda track. The density and the main orientation of the lineaments are compared with the degree of surface weathering. The geomorphology of the facies is an important control of the Spot spectral signatures. (5 refs.)

Symposium on Probing the Earth's Lithosphere by Controlled Source Seismology .... See Entry 64583

Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium) .... See Entry 64586

Iron-enriched basalt for containment of nuclear wastes .... See Entry 65361

Influence of irradiation with gamma-quanta and beam of accelerated electrons on the sorption parameters of clay minerals of the montmorillonite group [radioactive waste] .... See Entry 65436

Quaternary geology and neotectonics of the West flank of the northern Sangre de Cristo Mountains, south-central Colorado .... See Entry 69169

Tectonic elements registered on the Landsat imagery in area of Yugoslavia and their practical meaning .... See Entry 69189

Quality of upwelling radiance retrieved from Coastal Zone Colour Scanner (CZCS) data for ocean colour determination .... See Entry 69249

Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques .... See Entry 69389

92.00 HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

(for marine geology and geophysics, see 91.50)

92.10 PHYSICS OF THE OCEANS

(see also 43.30 Underwater sound)

69217 Equatorial long waves in geostationary satellite observations and in a multichannel sea surface temperature analysis. R.Legeckis, W.Pickel, G.Nesterczuk (Nat. Earth Satellite Service, Washington, DC, USA).
Bull. Am. Meteorol. Soc. (USA), vol.64, no.2, p.133-9 (Feb. 1983).
Geostationary satellite observations of a zonally oriented sea surface temperature front in the eastern equatorial Pacific were made between 1975 and 1981. Long waves appeared along the front mainly during the summer and fall, except during 1976, the year of an El Nino. The waves have averaged periods of 25 days and wavelengths of 1000 km. At the end of 1981, the long waves also were detected in a new sea surface temperature analysis based on multichannel infrared measurements from a polar-orbiting satellite. This quantitative analysis may improve the ability to resolve low-frequency equatorial waves motions from satellite observations. (21 refs.)

69218 Remote sensing of the sea-state using the 0.8-1.1 μm spectral band. L.Wald, J.M.Monget (Ecole Nat. Superieure des Mines de Paris, Valbonne, France).
Int. J. Remote Sens. (GB), vol.4, no.2, p.433-46 (April-June 1983).
Previous authors have reported on sea-state local variations detected by satellite in the 0.8-1.1 μm channel (Landsat MSS 7). The present authors demonstrate that in this channel the observed change in reflectance is mainly due to sea-state and use the Cox and Munk (1955) model to compute the sea-surface reflection coefficient for various geometrical conditions, and it is found that this model fits previous observations The model is then applied to cases of Landsat and SPOT sensors, and some useful recommendations are underlined. (19 refs.)

69219 Annual oceanic heat transports computed from an atmospheric model. J.R.Miller (Dept. of Meteorology & Phys. Oceanography, Rutgers Univ., New Brunswick, NJ, USA), G.L.Russell, Lie-Ching Tsang.
Dyn. Atmos. & Oceans (Netherlands), vol.7, no.2, p.95-109 (March 1983).
Mean annual estimates of the oceanic poleward energy transport are obtained using a global atmospheric general circulation model. The computations are carried out by using the atmospheric model to determine the net annual heat flux into the ocean on an 8°×10° grid. Assuming no net annual heat storage, the annual surface heat fluxes into any zonal band must be accompanied by a corresponding meridional heat transport in the ocean. The results are compared with several direct and indirect calculations of oceanic meridional heat transports. (29 refs.)

69220 On the response of ocean currents to atmospheric cooling. D.Nof (Div. of Meteorology & Phys. Oceanography, Rosenstiel School of Marine & Atmospheric Sci., Miami, FL, USA).
Tellus Ser. A (Sweden), vol.35A, no.1, p.60-72 (Jan. 1983).
The response of steady ocean currents to forced atmospheric cooling is examined by a simplified two-layer model. The study focuses on currents, such as the Gulf Stream, which lose their heat to the atmosphere as they flow from one region to another. The model is inviscid and includes no coupling between the ocean and the atmosphere. Approximate solutions for specified cooling processes acting steadily on currents whose undisturbed speed is uniform are obtained analytically using a uniformly valid power series expansion. Possible application of this theory to the separated Gulf Stream which loses heat to the atmosphere as it flows from Cape Hatteras toward the northeast is discussed. (15 refs.)

69221 A time dependent, two-layer frontal model of buoyant plume dynamics. J.O'Donnell, R.W.Gravine (Coll. of Marine Studies, Univ. of Delaware, Newark, DE, USA).
Tellus Ser. A (Sweden), vol.35A, no.1, p.73-80 (Jan. 1983).
The dynamics of buoyant plumes, such as those observed at the mouths of the Mississippi and Connecticut Rivers, is investigated by considering the one-dimensional, time dependent behaviour of a two-layer, frontal model. The equations governing the flow in the main body of the plume are the long wave equations. The flow at the frontal boundary is modeled using jump conditions which incorporate the important dissipative processes. These equations are solved numerically using a shock patching technique that is accurate to second order in the long wave region and to first order at the front. (19 refs.)

69222 The influence of optical water type on the diurnal response of the upper ocean. T.D.Dickey (Dept. of Geological Sci., Univ. of Southern California, Los Angeles, CA, USA), J.J.Simpson.
Tellus Ser. B (Sweden), vol.35B, no.2, p.142-54 (April 1983).
The effect of optical water characteristics upon the diurnal variability of upper ocean temperatures and heat content is studied. A second moment turbulent closure scheme is employed for the simulations. Realistic thermal forcing as well as uniform and time varying wind stresses were used for boundary conditions. The diurnal amplitude in sea surface temperature and long term changes in heat content are strongly influenced by water type for constant wind speeds up to 6 m s^{-1}. The phasing of time-dependent wind stresses can lead to enhanced diurnal sea surface temperature amplitudes. Long term trends in heat content, however, are nearly independent of phase. The results of the simulations are consistent with the range of reported observations. (53 refs.)

69223 Microprocessor simulation of variable sea conditions. C.K.Li, J.R.Leigh (Engng. Div., Polytech. of Central London, London, England).
Electron. Lett. (GB), vol.19, no.10, p.397-8 (12 May 1983).
The technique of using a digital filter to simulate sea conditions is investigated and the functional relation between pole variation in such a filter and a corresponding significant wave height is established. The implementation of the digital filter using a microprocessor is also considered. (4 refs.)

69224 Survey of a Gulf Stream frontal filament. L.J.Pietrafesa (Dept. of Marine, Earth & Atmospheric Sci., North Carolina State Univ., Raleigh, NC, USA).
Geophys. Res. Lett. (USA), vol.10, no.3, p.203-6 (March 1983).
An assortment of data is used to map and characterize a Gulf Stream filament. During 21-25 April 1980, a filament was captured as it moved through an array of moored current meters on the northeast Florida continental shelf. Current and temperature time series along with satellite VHRR and aircraft ART are used to reconstruct the event. The event is found to consist of an anticyclonically rotating, warm tongue inshore of a cold dome. The rotational scheme of the current in the warm tongue is opposite to previous hypotheses. Upwelling occurs in both the cold dome region and below the warm tongue. (11 refs.)

69225 A statistical dynamical theory of strongly nonlinear internal gravity waves. G.F.Carnevale (CSND, La Jolla Inst., La Jolla, CA, USA), J.S.Frederiksen.
Geophys. & Astrophys. Fluid Dyn. (GB), vol.23, no.3, p.175-207 (1983).
A statistical dynamical closure theory describing the interaction of strongly (and weakly) nonlinear two-dimensional internal waves in the presence of viscous dissipation and thermal conduction is derived. By applying renormalization methods originally formulated for quantum and classical statistical field theory, closures similar to the Direct Interaction and eddy-damped quasi-normal procedures of turbulence are derived. These methods are applied directly to the strongly nonlinear primitive field equations in Eulerian variables, thus avoiding the small amplitude assumptions inherent in the resonant interaction formalism. Propagator renormalization techniques provide formulas for the nonlinear internal wave frequency and spectral width in terms of the energy spectrum. The commonly used multiple time and space scale analysis is replaced by an analysis of the two-point correlation functions in terms of sum and difference variables. This permits the systematic development of a Landau equation. This generalization of the Boltzmann equation incorporates spatial variation of the group velocity and scattering due to spatial inhomogeneity. In the limit of weakly interacting waves and zero viscosity, the closures reduce to the resonant interaction approximation formalism. It is shown that the inviscid resonant interaction limit is singular in the sense that the equilibrium spectrum differs from that of the general

inviscid nonlinear off-resonant case. This is due to the fact that in the resonant interaction limit there is an additional constant of motion, viz. 'z-momentum'. The implications of these results are discussed. (55 refs.)

69226 Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. I. Experiments. M.A.Azouni (Lab. d'Aerothermique, Meudon, France), C.Normand.
Geophys. & Astrophys. Fluid Dyn. (GB), vol.23, no.3, p.209-22 (1983).
Thermoconvective instabilities were investigated in cylindrical water layers under a 0-4°C vertical temperature gradient. For aspect ratios (height/diameter) ranging from 0.3 to 5.7, angular flow patterns were deduced from thermocouple measurements. The first two diametrically antisymmetrical modes ($n=1$, 2) were detected in the steady and unsteady regime. Slow oscillatory motions with a characteristic time of several hours were found for aspect ratios (height/diameter) larger than 2. The Fourier analysis of the angular temperature distribution at regular time intervals yields the result that the vertical nodal planes rotate around the cylinder axis in the oscillatory regime. A physical mechanism is suggested to explain the occurrence of such oscillatory instability. (17 refs.)

69227 Thermoconvective instabilities in a vertical cylinder of water with maximum density effects. II. Theory: onset of convection. M.A.Azouni (Lab. d'Aerothermique, Meudon, France), C.Normand.
Geophys. & Astrophys. Fluid Dyn. (GB), vol.23, no.3, p.223-45 (1983).
For pt.I see ibid., vol.23, no.3, p.209-22 (1983). The onset of convection in a vertical cylinder of water with regard to the density anomaly near 4°C is studied using linear stability analysis. Since the maximum density is located at the top of the cylinder, making the whole height of the cell gravitationally unstable, the Boussinesq equations are solved by the Galerkin method. Also for the special case of axisymmetrical flow pattern, direct numerical procedure and analytical method have been used. Special emphasis is given to the large aspect ratio limit (height of cylinder much larger than radius) for which the combined influence of the sidewalls and the nonlinear density gradient gives rise to a nonsymmetrical axial velocity profile. The maximum of the velocity amplitude is shifted towards the bottom of the cylinder as the aspect ratio increases and consequently the critical Rayleigh number is lower than when a linear density gradient is assumed. (28 refs.)

69228 The shape of the spectrum of energy containing components of the water surface in the weakly turbulent theory of wind waves. V.E.Zakharov, M.M.Zaslavsky.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.282-91 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
It is shown that for sufficiently developed wind waves the shape of the spectrum in the energy containing range is defined by dimensional considerations of the transfer equation for wind waves where the Kolmogorov's spectrum with respect to wave action flux p $S(\omega)=ap^{1/3}g^{4/3}\omega^{-11/3}\Theta_s(\omega/\omega_m)$ is realised (a is the non-dimensional coefficient dependent on the angular energy distribution for $\omega\sim\omega_m$, Θ_s is the 'spreaded' Heaviside function cutting the spectrum at the frequency of the spectrum maximum ω_m). The expression for $S(\omega)$ obtained is in a reasonable agreement with experimental data which permit to determine the non-dimensional coefficient a (≈ 0.83). A general qualitative picture of wind wave spectrum development is discussed which permits explanation of a number of their known properties: location of equilibrium range in the small scale part of the wave spectrum, the overshoot effect in the growth curves of spectral components, the decrease of the measure of narrowness of the wave spectrum in the course of wave development. (13 refs.)

69229 On mesoscale currents variability near North-West Africa. Yu.L.Djomin, E.Khagen, A.M.Gurina.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.292-300 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
A nonlinear numerical model has been used to simulate mesoscale and climatic currents near North-West Africa. The role of boundary conditions as well as horizontal and vertical eddy viscosity coefficients is discussed. Model results are compared with observed data on currents and hydro-chemical fields. (13 refs.)

69230 On the fine structure of the waters in the central part of the Red Sea. Yu.V.Nozdrin, E.A.Plakhin.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.301-8 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Results of fine structure observations and time-space variability of the Red Sea waters are presented with calculations of fluctual components and parameters of fine structure. Analysis of these characteristics has yielded to conclusion of non-isopycnal origin of observed details of fine structure profiles and also to the connection between their variability in thermocline with semi-diurnal internal waves. (10 refs.)

69231 A baroclinic quasigeostrophic open ocean model. R.N.Miller, A.R.Robinson, D.B.Haidvogel (Div. of Appl. Sci., Harvard Univ., Cambridge, MA, USA).
J. Comput. Phys. (USA), vol.50, no.1, p.38-70 (April 1983).
A baroclinic quasigeostrophic open ocean model is presented, calibrated by a series of test problems, and demonstrated to be feasible and efficient for application to realistic and mid-oceanic mesoscale eddy flow regimes. Two methods of treating the depth dependence of the flow, a finite difference method and a collocation method, are tested and intercompared. Sample Rossby wave calculations with and without advection are performed with constant stratification and two levels of nonlinearity, one weaker than and one typical of real ocean flows. Using exact analytical solutions for comparison, the accuracy and efficiency of the model is tabulated as a function of the computational parameters and stability limits set; typically, errors were controlled between 1% and 10% RMS after two wave periods. Further Rossby wave tests with realistic stratification and wave parameters chosen to mimic real ocean conditions were performed to determine computational parameters for use with real and simulated data. Finally, a prototype calculation with quasiturbulent simulated data was performed successfully, which demonstrates the practicality of the model for scientific use. (23 refs.)

69232 The K_1 tide on the continental shelf from Nova Scotia to Cape Hatteras. P.R.Daifuku, R.C.Beardsley (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.3-17 (Jan. 1983).
A description is given of the K_1 tide over the northeast continental shelf off North America from Nova Scotia to Cape Hatteras. A K_1 cotidal map and current velocity map are presented. Offshore, there is a sweep of the tide from north to south, in general agreement with what is known of the oceanic K_1 tide in the North Atlantic. On the shelf, there is a trapping of phase lines to the coast, creating, in particular, a virtual amphidrome south of Cape Cod. Maximum amplitudes of around 15 cm are found in the Gulf of Maine, lowest around 7 cm south of Cape Cod. The K_1 currents are generally barotropic and current ellipses are aligned with the local topography. Maximum currents of about 10 cm s^{-1} are found south of Cape Cod. A simple model for the K_1 pressure field is developed, using the free and forced inviscid barotropic waves on a two-dimensional shelf. The model results confirm that the K_1 tide is composed of both a Kelvin wave and a shelf wave. (20 refs.)

69233 Propagation of the seasonal upwelling in the eastern equatorial Atlantic. J.Picaut (Lab. d'Oceanographie Phys., Univ. de Bretagne Occidentale, Brest, France).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.18-37 (Jan. 1983).
Several mechanisms have been proposed to explain the coastal and equatorial upwelling in the eastern Atlantic (Guinea Gulf). The most controversial is the mechanism of remote wind forcing in the western equatorial Atlantic suggested by Moore et al. (1978). Most of the possible explanations for the upwelling and their relative importance are discussed in view of recent observations. Detailed analysis of daily sea surface temperature (SST) collected at 16 coastal stations along the northern coast of the Guinea Gulf reveals that the upwelling event propagates westward along this coast at a mean speed of 0.7 m s^{-1}. The Northern Hemisphere and Southern Hemisphere coastal upwelling signals seem to start at the same time from the equator. These results and those of Servain et al. (1982) suggest that remote wind forcing west of the Gulf of Guinea is an important factor affecting the temperature in the Gulf. (75 refs.)

69234 On the potential energy of baroclinic Rossby waves in the North Pacific. L.Magaard (Dept. of Oceanography, Univ. of Hawaii, Honolulu, HI, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.38-42 (Jan. 1983).
Estimates of baroclinic Rossby wave potential energy spectra for various parts of the North Pacific were calculated from published material containing information about this energy in many different formats, definitions and units. The standardized results lead to frequency spectra of potential energy, ranging from 0.1 to 0.45 cpy (cylces per year), in 34 5° squares between 20 and 30°N; to energy spectra, ranging from 0.28 to 2.11 cpy, in eight subsections of the great circle route from Honolulu to San Francisco; and to a map of annual Rossby wave energy between 30 and 40°N. The most remarkable finding is a consistent sequence of interannual Rossby wave spectra, with a peak at 0.15 cpy (i.e., at a wave period of 6.7 years) covering the area 20-25°N and 175-130°W. (16 refs.)

69235 The effect of a mean current on Kelvin waves. R.Grimshaw (Dept. of Math., Univ. of Melbourne, Parkville, Victoria, Australia).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.43-53 (Jan. 1983).
The effect of a mean current on Kelvin waves is considered, including the case when the current is not in geostrophic balance. Because the problem is non-separable, a perturbation scheme is developed for weak shear from which the effect of the mean current on the wave phase speed and decay rate are determined. The perturbation scheme also establishes that in general the Kelvin wave contains all vertical modes. The special case of a two-layer fluid is considered in more detail. (3 refs.)

69236 Longshore coherence of currents on the Southern California shelf during the summer. C.D.Winant (Scripps Instn. of Oceanography, La Jolla, CA, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.54-64 (Jan. 1983).
Observations of horizontal currents and temperature made along a mid-shelf isobath during the summer on the Southern California shelf are used to determine longshore coherent length scales. The observations are characterized by weak atmospheric forcing and strong density stratification of the water column. For periods longer than a day, coherent longshore length scales of currents are around 25 km, while coherent length scales of temperature were longer than the instrumental array (57.5 km). For periods ranging from a day to an hour, near-surface motions were dominated by diurnal fluctuations which were coherent over lengths of 5 km, whereas near-bottom motions, dominated by semidiurnal fluctuations, showed evidence of a signal propagating up coast at phase speeds of order 1 m s^{-1}. The observed scales of motion in different frequency bands are used to estimate the dispersive properties of the shelf motions. (13 refs.)

69237 Summertime coastal currents in the northeastern Gulf of Mexico. G.O.Marmorino (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.65-77 (Jan. 1983).
Observations of currents and temperature at a mooring on the 18 m isobath, 30 km south of the Florida shoreline, are discussed for the 31-day period 15 August-15 September 1978. Tidal currents, having average amplitudes of ~10 cm s^{-1}, account for 85% of the observed kinetic energy. Low-frequency currents with maximum speeds of ~10 cm s^{-1} appear to be at least partly driven by local wind-stress events of magnitude ~0.2 dyn cm^{-2}. Frictional effects give rise to a veering with depth (in the Ekman sense) of both the low-frequency flow and the energetic, counterclockwise-rotating twice-daily tidal currents. Propagation of both the tidal signal and low-frequency coastal sea-level fluctuations (amplitudes <5 cm) is westward through the study area. (23 refs.)

69238 Mean flow generation on a continental margin by periodic wind forcing. D.W.Denbo, J.S.Allen (School of Oceanography, Oregon State Univ., Corvallis, OR, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.78-92 (Jan. 1983).
The generation of an alongshore mean flow by the nonlinear interaction of forced barotropic shelf waves over a continental margin is studied using a wind-forced, f-plane model with bottom friction in an attempt to develop a model for poleward eastern boundary undercurrents. It is assumed that the Rossby number is small and that the flow obeys a long-wave approximation. A periodic alongshore wind stress traveling along the coast forces the fluid by a nonzero wind stress at the coast (coastal forcing) or by a wind-stress-curl-driven oceanic flow that impinges on the slope (interior forcing). Expressions are derived for the alongshore (v) and cross-shelf (u) mean velocities in terms of the lowest order periodic velocities. An expression for the correlation coefficient of uv_x, where x is the cross-shelf coordinate, is derived that depends only on the sign of the bottom slope, the magnitude of friction, the local water depth and the forcing frequency. The momentum flux and Reynolds stress in the surface and bottom Ekman layers make a significant contribution to the mean flow. Further aspects of the flow are described. (19 refs.)

69239 Small-scale variations of the wind-driven coastal sea-level response in the West Florida Bight. G.O.Marmorino (Dept. of Oceanography, Florida State Univ., Tallahassee, FL, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.93-102 (Jan. 1983).
Records from a number of temporary tide gage stations spaced an average of 20 km apart near Cedar Key, Florida, are used to examine the alongshore pressure gradient over length scales much smaller than before possible. In agreement with previous studies, an alongshore stress of 1 dyn cm^{-2} will produce a large-scale (over distances of several hundred kilometers) alongshore sea-level gradient on the order of 10^{-6}, sea level rising downwind. However, cross-shore stress is also important and, at short periods (~3.5

days), can be the more coherent forcing. Estimates of small-scale sea-level slope do appear to show systematic deviations from the larger scale slope, some of which seem to be related to alongshore variations in nearshore bathymetry. (10 refs.)

69240 Low-frequency free wave and wind-driven motions over a submarine bank. K.H.Brink (Woods Hole Oceanographic Instn., Woods Hole, MA, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.103-16 (Jan. 1983).
This study attempts to isolate the physics peculiar to a submarine bank. The particular model is barotropic and contains an infinitely long straight bank within an unbounded ocean basin. The low-frequency, free wave solutions consist of two infinite sets of modes, analogous to barotropic continental shelf waves, one set trapped to each side of the bank. In addition, a severely distorted double Kelvin wave is associated with the net depth difference across the bank. Inclusion of bottom friction representative of Georges Bank suggests that only one free wave (westward propagating on the south side) will have a sufficiently long decay time to be likely to be observed in nature. The spatial variation in local spindown time also causes the lines of constant wave phase to be no longer perpendicular to the isobaths. Steady, forced motions are considered for winds which vary slowly in the alongbank direction. When the Ekman scale depth is the same order as the minimal depth over the bank, the primary driving mechanism is related to the disruption of surface Ekman transport by bottom friction. (19 refs.)

69241 The wake of Hurricane Allen in the western Gulf of Mexico. D.A.Brooks (Dept. of Oceanography, Texas A&M Univ., College Station, TX, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.117-29 (Jan. 1983).
In August 1980, Hurricane Allen passed over a moored array of instruments recording current, temperature and conductivity in the western Gulf of Mexico. An alongshore surge occurred during the storm passage, with the horizontal current speed reaching 91 cm s^{-1} in the thermocline (200 m) and diminishing to 15 cm s^{-1} 32 m above the bottom (732 m). A wake of near-inertial frequency internal waves commenced after the storm passed the array. The alongshore current oscillation reached a maximum range of 50 cm s^{-1} within 3 days and decayed thereafter with a time scale of about 5 days. The current oscillations were clockwise-polarized and slightly elliptical, with a period of 22-23 h or about 85% of the local inertial period. Near-uniform upwelling of ±20 m occurred in the thermocline region (200-300 m) during the most intense part of the wake. Depth-leading phases of the horizontal current and temperature oscillations indicated downward radiation of wake energy. The wake oscillations were studied in detail. (13 refs.)

69242 Air-sea interaction as a propagator of equatorial ocean surface temperature anomalies. E.B.Kraus, H.P.Hanson (Cooperative Inst. for Res. in Environmental Sci., Univ. of Colorado, Boulder, CO, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.130-8 (Jan. 1983).
The westward propagation of equatorial sea surface temperature anomalies exceeds the surface drift velocity and is probably associated with propagating changes in the depth of the surface mixed layer and upper thermocline. These can be caused by equatorial Rossby waves and/or by air-sea interactions. In the present paper, it is shown that changes in the stress and heat flux associated with the passage of the air over an ocean surface of variable temperature can produce a westward propagation of the temperature pattern regardless of Coriolis effects. The phenomenon is investigated in the framework of a two-layer channel model. (19 refs.)

69243 Topographically controlled flow around a deep trough transecting the shelf off Kodiak Island, Alaska. G.Lagerloef (Pacific Marine Environmental Lab., NOAA, Seattle, WA, USA).
J. Phys. Oceanogr. (USA), vol.13, no.1, p.139-46 (Jan. 1983).
Current measurements from the axis of a deep trough normal to the coast and from the adjacent shelf show that the mean flow is barotropic and follows depth contours, conserving potential vorticity, to form a cyclonic vortex or meander over the trough. The data are interpreted as an example of an inertial Taylor-Proudman column on the continental shelf. The scale of the topographic variations dominates the potential vorticity balance and a simple steady-state numerical model is in good agreement with the data when the vorticity balance approaches the limit $\mathbf{U}.\nabla H=0$. Streamlines following isobaths converge over steeper topography and current speeds are nearly proportional to the local topographic gradient. Estimates from the data support this behavior and indicate that the $\sim$20 cm s^{-1} mean current around the trough is driven by a typical cross-shelf-averaged velocity scale of $\sim$5 cm s^{-1}. (16 refs.)

69244 Reflectance contrast observed by Landsat between a calm and a rough sea. L.Wald, J.M.Monget (Ecole Nat. Superieure des Mines de Paris, Valbonne, France).
Photogramm. Eng. & Remote Sensing (USA), vol.49, no.2, p.241-2 (Feb. 1983).
A model is used to predict changes in reflection coefficient as a function of wind speed. (14 refs.)

69245 New ice-forecasting procedures for the northwest Atlantic. B.A.Kogan, N.F.Orlov (Arctic & Antarctic Sci. Res. Inst., Murmansk, USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.57-69 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.71-6 (1981).
Studies oriented to the development of new ice-forecasting procedures for the Davis and Denmark Straits and the Labrador Sea are reported. (6 refs.)

69246 Formation mechanisms of the oceanic mixed layer. B.D.Zholudev (Kabardino Balkarian State Univ., USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.61-6 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.77-82 (1981).
Relates laboratory study of the mixed layer, observations of its state in the open ocean, and numerical one-dimensional models of the upper layer of the ocean. Mixed layer characteristics are calculated for a storm observed in middle latitudes with allowance for the diurnal insolation cycle. (27 refs.)

69247 Interaction of swell waves with head winds. V.K.Makin (Leningrad Div., Inst. of Oceanology, USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.79-81 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.95-7 (1981).
A numerical model of the wind-wave interaction is used to investigate the damping of swell waves of 50 to 200 metres long under the action of a head wind. The damping time depends strongly on the frequency of the wave, increasing with decreasing frequency. For short swell waves it is necessary to take account of the energy lost in the interaction of the wave with the head wind. (7 refs.)

69248 A dynamical model of storm surges along island coasts. M.A.Fahmy, M.Zaki (Dept. of Engng. Math., Cairo Univ., Giza, Egypt).
Z. Angew. Math. & Phys. (Switzerland), vol.34, no.2, p.154-63 (March 1983).
A time-independent dynamical model of storm surge along island coasts using orthogonal curvilinear coordinates is presented. The curved annulus between an island coast and an arbitrary deep-water boundary is mapped conformally onto a rectangular image. Two configurations of island coasts are investigated; circular and elliptic coasts. The corresponding coordinates are circular polar and elliptic respectively. The linearized vertically-integrated equations of motion are used to model storm surges with two assumptions: (i) bottom stress is proportional to horizontal transport, and (ii) storm forces are shear stresses on water surface. Analytical solutions are presented for three dynamical cases: (i) a constant-depth basin acted upon by a uniform storm stress, (ii) variable-depth basin acted upon by a uniform-direction variable-magnitude stress, and (iii) a basin with closed depth contours acted upon by vortex-shaped storm stress. (7 refs.)

69249 Quality of upwelling radiance retrieved from Coastal Zone Colour Scanner (CZCS) data for ocean colour determination. S.M.Singh (Carnegie Lab. of Phys., Univ. of Dundee, Dundee, Scotland).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.697-706 vol.1
Discusses the inflight calibration quality of the Coastal Zone Colour Scanner (CZCS) detector. The atmospheric correction algorithm currently in use is based on the assumptions that (i) the aerosol path radiance is not attenuated by the Rayleigh atmosphere, (ii) the Rayleigh path radiance is not attenuated by the aerosol atmosphere and (iii) the azimuthal angle of the satellite-sensed radiation is a constant. The author develops another algorithm which does not use these assumptions. Some of the difficulties associated with these atmospheric correction algorithms are discussed. The author also includes a brief discussion on the uncertainty in the chlorophyll-like pigment concentrations. (27 refs.)

69250 Study of tidal vortices at the Naruto Strait through multi level remote sensing. T.Maruyasu, S.Onishi, T.Nishimura (Sci. Univ. of Tokyo, Chiba, Japan).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.735-44 vol.1
Stirring whirlpools in the tidal stream at the Naruto Strait were surveyed through multi level remote sensing from airplane and Landsat. Small scale tidal vortices were surveyed from air at lower altitude, and the large scale tidal vortices were surveyed from Landsat and from air at higher altitude. It was revealed that the tidal vortices take the main role in the water mixing around the strait, after the hydrodynamical interpretation of the remotely sensed data aided by the hydraulic model tests. (1 ref.)

69251 Microwave signatures of young sea ice and its influence on ice concentration algorithms. C.Matzler (Inst. of Appl. Phys., Univ. of Berne, Berne, Switzerland).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.757-65 vol.1
Passive and active microwave signatures show large variations when new sea ice is formed in the marginal ice zone. Whereas the emissivities increase monotonically with increasing ice thickness as a result of decreasing surface wetness, no monotonic change is found for backscattering coefficients due to the strong influence of the surface roughness. Therefore, passive sensors are preferable for ice concentration algorithms. These results are based on measurements of microwave signatures made from icebreaker based instruments during the Norwegian remote sensing experiment in 1979. (6 refs.)

69252 Sea ice classification from infrared thermometry over the North Water, winter 1980/81. K.Steffen (Dept. of Geography, Swiss Federal Inst. of Technol., Zurich, Switzerland).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.767-76 vol.1
Report a sea ice remote sensing study carried out within the framework of a larger research project concerned with the so called North Water. The N.W. is recurring polynya (an Arctic sea anomaly associated with a high percentage of young ice and open water) and one of the largest such phenomena in the Northern Hemisphere. The goal of the N.W. project is the study of the attributes of this polynya and of its modifying effects on the regional climate. The author carried out six remote sensing flights at an altitude of 300 m with a total profile length of 2300 km each. A precision radiation thermometer (PRT-5) served to measure the thermal radiation emitted by the sea surface. It was found that different sea ice types are associated with distinguishable surface temperature levels and it is therefore possible to derive a sea ice classification from the thermal radiation measurements. For the Lancaster Sound the relation between occurrence frequency of fractures (expressed in class percentages) and fracture width was investigated. (7 refs.)

Mine-derived metal pollution in the Isle of Man .... See Entry 68905

Continental lithospheric thickness and deglaciation induced true polar wander .... See Entry 69143

Radiocarbon in the Weddell Sea as observed in a deep-sea coral and in krill .... See Entry 69253

Modelling nearshore oil slick trajectories .... See Entry 69254

Consistent balanced models in bounded and periodic domains .. See Entry 69286

Dynamics of singular geostrophical vortices in a two-level model of the atmosphere (ocean) .... See Entry 69295

Turbulence with a spectral gap .... See Entry 69302

An operational program for monitoring surface temperatures of lakes and coastal-zone waters in Canada from polar-orbiting satellite infrared data .... See Entry 69332

Water depth mapping from passive remote sensing data under a generalized ratio assumption .... See Entry 69333

Grid generation for environmental flows .... See Entry 69387

Microwave remote sensing of sea ice .... See Entry 69390

92.20 INTERDISCIPLINARY ASPECTS OF OCEANOGRAPHY

69253 Radiocarbon in the Weddell Sea as observed in a deep-sea coral and in krill. R.L.Michel (Scripps Instn. of Oceanography, La Jolla, CA, USA), E.M.Druffel.
Geophys. Res. Lett. (USA), vol.10, no.3, p.190-2 (March 1983).
Radiocarbon measurements were performed on krill and coral samples collected from the Weddell Sea during IWSOE '80. These are the first radiocarbon measurements available from this area since 1973. These data reveal carbon-14 levels for Weddell surface water and southern Weddell Shelf water. These data indicate that the radiocarbon levels in surface waters in 1980 were the same or slightly lower than those present in 1973. In addition, an unusually low $\Delta^{14}C$ value for shelf water (from coral) at 500 m is evidence that Warm Deep Water (WDW) may penetrate much further and more frequently onto the shelf region than had previously been expected. (16 refs.)

69254 Modelling nearshore oil slick trajectories. T.Beer (Centre for Resource & Environmental Studies, Australian Nat. Univ., Canberra, Australia), R.B.Humphries, R.Bouwhuis.
Mar. Pollut. Bull. (GB), vol.14, no.4, p.141-4 (April 1983).
The need to assess the probability of accidental oil spills, and their fate, in the Spencer Gulf, was one of the major problems addressed by the draft environmental impact statement for the proposed Cooper Basin liquids project facility at Stony Point, South Australia. As a first stage in the assessment of this risk, an oil spill trajectory model was constructed in order to determine the likely fate of spilled oil over all seasonal conditions. The choice of appropriate counter-measures were guided by the results of this model. Features of the model included: (i) a concentration upon environmental impact assessment. To achieve this the model was biased so as to overestimate environmental damage in sensitive areas; (ii) the use of a matrix wind factor to describe wind effects on the oil; (iii) model verification through the use of model output statistics linking model results with field trials; (iv) validation of the model with a series of experiments six months after the original field trials. (6 refs.)

69255 Marine litter distribution and composition in the North Sea. T J.Dixon, T.R.Dixon.
Mar. Pollut. Bull. (GB), vol.14, no.4, p.145-8 (April 1983).
Following the development of marine litter surveillance methodologies for use on beaches, this study shows the feasibility of similar surveys at sea. The results indicate widespread distribution of marine litter in the surface waters of the North Sea, especially plastics. Not only does this draw attention to the need for the implementation of Annexe V of the MARPOL Convention, but serious consideration should be given now to the designation of the North Sea as a 'special area' such that the dumping of all garbage from ships, except food wastes, should be prohibited. (14 refs.)

Mercury and chlorinated hydrocarbons in sediments from the Bay of Naples and adjacent marine areas .... See Entry 68904

Mine-derived metal pollution in the Isle of Man .... See Entry 68905

Alteration of basaltic glass: mechanisms and significance for the oceanic crust-seawater budget .... See Entry 69145

East Pacific Rise near 13°N: geology of new hydrothermal fields .... See Entry 69191

92.40 HYDROLOGY AND GLACIOLOGY

69256 A dynamical model for the overland flow on an infiltrating catchment. K.Pingoud (Systems Theory Lab., Helsinki Univ. of Technol., Espoo, Finland).
Appl. Math. Modelling (GB), vol.7, no.2, p.128-34 (April 1983).
An approximate lumped parameter model for the surface runoff phenomenon on a catchment is presented. It consists of two submodels, which are spatial discretizations of the basic partial differential equations of overland flow and infiltration. The aim of the model is to describe the dynamical input-output relationship between the rainfall rate and the surface runoff from the catchment. The boundary conditions of the infiltration process are modelled in an approximate way so that the number of state variables in the model can be reduced. With the aid of a single model parameter it is possible to describe simple catchment shapes like linearly converging and diverging surfaces. The model structure is flexible so that it can also be applied to more complex catchment configurations. (21 refs.)

69257 Using Landsat imagery interpretation for underground water prospecting around Qena Province, Egypt. A.B.Salman (Remote Sensing Centre, Nuclear Materials Corp., Cairo, Egypt).
Int. J. Remote Sens. (GB), vol.4, no.2, p.179-89 (April-June 1983).
Deals with visual interpretation of Landsat satellite images covering an area of 27000 km^2 around Qena Province, Upper Egypt. Geological, structural lineaments and drainage density maps are constructed. From these maps the significant hydrogeological features are extracted, correlated and utilised in locating some areas of high underground water content. (9 refs.)

69258 The chemistry of geothermal waters in Iceland. II. Mineral equilibria and independent variables controlling water compositions. S.Arnorsson, E.Gunnlaugsson (Sci. Inst., Univ. of Iceland, Reykjavik, Iceland), H.Svavarsson.
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.547-66 (March 1983).
For pt.I see ibid., vol.46, p.1513-32 (1982). The major element chemistry of Icelandic geothermal waters is predictable provided two parameters are known. This follows from an attainment of, or a close approach to, an overall chemical equilibrium in the geothermal systems at temperatures as low as 50°C. It is considered that the geothermal system composition, temperature and kinetic factors determine which alteration minerals form. The system composition is not so much fixed by rock composition as by the rate of leaching of the various constituents from the fresh rock and the composition of inflowing water. The water chemistry is determined by the system composition and the external variables acting on the system. They include temperature and the mobility of chloride. (36 refs.)

69259 Evaluating space-time variability of heat and water balance components on the eastern part of the Baikal-Amur trunkline right-of-way. V.N.Adamenko, A.L.Bodganov, P.V.Novorotskii (Inst. of Limnology, Acad. of Sci, USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.47-56 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.58-70 (1981).
Remote methods for measurement of underlying-surface albedos and temperatures are used as a basis for estimation of the spatial variability of albedo, radiation temperature, and radiation balance for characteristic landscape types along the eastern right-of-way of the Baikal-Amur Trunkline. Heat and water balance components are estimated theoretically as functions of slope exposures and gradients under the conditions of mid-mountain terrain. Heat-balance components and their relationships are estimated from observations made on seven test plots. (20 refs.)

69260 Relationships for predicting maximum ice-dam (ice-run) water levels at the spring opening of Siberian rivers. I.Ya.Liser (Western Siberian Regional Sci. Res. Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.67-71 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.83-7 (1981).
A proposal for predicting maximum damming (ice-run) water levels at the spring opening of Siberian rivers is offered. It is also proposed that early-winter water levels, which characterize icing conditions, be included in the forecasting. (10 refs.)

69261 Joint estimation of annual and multiyear probabilities of water discharge volumes exceeding the daily averages. A.M.Komlev (Perm State Univ., Perm, USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.82-4 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.97-100 (1981).
It is proposed that the annual and multiyear variabilities of hydrometeorological elements be estimated from persistence-time curves of equiprobable values. An example in which these curves are constructed from the daily-average volumes of the Kama River at Bondyug is presented. (10 refs.)

69262 A three dimensional hybrid finite element-finite difference scheme for groundwater simulation. D.K.Babu, G.F.Pinder (Dept. of Civil Engng., Princeton Univ., Princeton, NJ, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.292-4, vol.2
A hybrid finite element-finite difference scheme that employs finite elements in the areal directions and finite difference approximations in the vertical directions, is constructed for solving transient groundwater flow problems. The scheme is applied to predict the transient hydraulic heads generated in a finite, confined aquifer receiving water from a partially penetrating injection well of finite radius. Heuristic error analysis is presented for this problem. (2 refs.)

69263 Automatic mapping of lakes for small-scale maps using digital Landsat imagery. E.A.Fleming (Surveys & Mapping Branch, Dept. of Energy, Mines & Resources, Ottawa, Canada).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.965-70 vol.1
In much of Canada, lakes predominate the landscape, but the cartographic generalization employed in producing maps at scales of 1:500000 and 1:1000000 often fails to capture this aspect of the terrain. A more realistic rendition of the hydrology can be obtained if the conventional cartography of drainage is combined with lakes as imaged on Landsat MSS. Thematic extraction of the water using geometrically corrected digital imagery has proved feasible for this purpose. (no refs.)

The use of ^{222}Rn as a flow path monitor for studies of radionuclide transport in fissures .... See Entry 65374

Site characterisation for field radionuclide migration studies in Climax granite .... See Entry 65376

Nuclide migration field experiments in tuff, G tunnel, Nevada Test Site .... See Entry 65377

Predicting Pu concentrations in solutions contacting geologic materials .... See Entry 65378

Transient hydraulic tests in granite: fissured porous medium analysis and results .... See Entry 65379

Radionuclide migration: laboratory experiments with isolated fractures .... See Entry 65381

Radiogeological assessment of candidate sites for nuclear waste repositories, exemplified by studies of the Stripa Pluton, Sweden .... See Entry 65386

Diffusion measurements in compacted bentonite .... See Entry 65388

The dissolution of irradiated fuel under hydrothermal conditions .... See Entry 65391

Permeability, swelling and radionuclide retardation properties of candidate backfill materials .... See Entry 65392

Mechanisms of dissolution of radioactive waste storage glasses and caesium migration from a granite repository .... See Entry 65394

Experimental and theoretical analyses of small-scale radionuclide migration field experiments .... See Entry 65397

Reference laboratory testing for backfill .... See Entry 65398

Novel experiments for understanding the shallow land burial of low-level radioactive wastes .... See Entry 65404

Stochastic analysis of groundwater flow and contaminant transport in a fractured rock system .... See Entry 65406

INTRACOIN—an international nuclide transport code intercomparison study .... See Entry 65465

The solubility of noble gases in water and in NaCl brine .... See Entry 67214

Accumulation of mercury in fish and man from reservoirs in northern Finland .... See Entry 68906

Modeling thermal plumes in tidal rivers .... See Entry 68907

Seasonal variations of Cd, Pb, Cu and Ni levels in snow from the eastern Arctic Ocean .... See Entry 68911

Comment on 'A paleomagnetic record from Tangle Lakes, Alaska: large amplitude secular variation at high latitudes' by K.L. Verosub .... See Entry 69104

Continental lithospheric thickness and deglaciation induced true polar wander .... See Entry 69143

The development and application of a geological simulation model .... See Entry 69204

A time dependent, two-layer frontal model of buoyant plume dynamics .... See Entry 69221

Foreshadowing northeast monsoon rainfall over Tamil Nadu, India .... See Entry 69276

Fluctuations in the drought/flood area over India and relationships with the Southern Oscillation .... See Entry 69316

An operational program for monitoring surface temperatures of lakes and coastal-zone waters in Canada from polar-orbiting satellite infrared data .... See Entry 69332

Water depth mapping from passive remote sensing data under a generalized ratio assumption .... See Entry 69333
Using midday surface temperature to estimate daily evaporation from satellite thermal IR data .... See Entry 69336
Grid generation for environmental flows .... See Entry 69387
Microwave signatures and mapping of snow .... See Entry 69391

92.60 METEOROLOGY

(see also 43.28 Aeroacoustics and atmospheric sound)

69264 Observations of optical lightning emissions from above thunderstorms using U-2 aircraft. H.J.Christian, R.L.Frost, P.H.Gillaspy, S.J.Goodman, O.H.Vaughan,Jr. (George C. Marshall Space Flight Center, AL, USA), M.Brook, B.Vonnegut, R.E.Orville.
Bull. Am. Meteorol. Soc. (USA), vol.64, no.2, p.120-3 (Feb. 1983).
In order to determine how to achieve orders of magnitude improvement in spatial and temporal resolution and in sensitivity of satellite lightning sensors, better quantitative measurements of the characteristics of the optical emissions from lightning as observed from above tops of thunderclouds are required. A number of sensors have been developed and integrated into an instrument package and flown aboard a NASA U-2 aircraft. The objectives have been to acquire optical lightning data needed for designing the Lightning Mapper Sensor, and to study lightning physics and the correlation of lightning activity with storm characteristics. The instrumentation and observations of the program are reviewed and their significance for future research is discussed. (6 refs.)

69265 Some hail research in China. Jia-liu Xu (Office of Weather Res. & Modification, NOAA/ERL-CIRES, Boulder, CO, USA).
Bull. Am. Meteorol. Soc. (USA), vol.64, no.2, p.124-32 (Feb. 1983).
Considers the geographical and seasonal distributions of hail in China, hailstorm structure, hail embryos, hailstone stratification and hail size distributions, graupel, and cloud and hail growth models. (15 refs.)

69266 The 1980-81 drought in eastern Pennsylvania. D.J.Perkey, K.N.Young, C.W.Kreitzberg (Dept. of Phys. & Atmospheric Sci., Drexel Univ., Philadelphia, PA, USA).
Bull. Am. Meteorol. Soc. (USA), vol.64, no.2, p.140-7 (Feb. 1983).
Investigates the causes and consequences of the 1980-1 drought as it affected eastern Pennsylvania. Precipitation data indicate below-average amounts during this period, while temperature records show above-average values. These values show that a meteorological drought did occur in this region during 1980 and 1981. However, meteorological factors were only part of the cause of the region's water-shortage. In addition to analyzing the drought's meteorological origin, this study probes the anthropogenic and regional social-political causes and impacts of the water shortage. Some of the complexities involved in trying to prepare for the normal fluctuations in a climatic variable such as precipitation amount are illustrated. (12 refs.)

69267 A note on the relationship between relative precipitation frequency and percent of correct forecasts. R.J.Reed (Dept. of Atmospheric Sci., Univ. of Washington, Seattle, WA, USA).
Bull. Am. Meteorol. Soc. (USA), vol.64, no.2, p.148-9 (Feb. 1983).
The theoretical relationship between these quantities is derived for the full range of precipitation frequency with use of a model that assumes the forecasts to be unbiased and the Heidke Skill Score to be independent of precipitation frequency. It is shown that for this simple model the relationship is quadratic. (2 refs.)

69268 Fast Fourier transform for numerical weather prediction models on vector computers. C.Temperton.
Bull. Dir. Etud. & Rech. Ser. C (France), no.1, p.159-62 (1983). In English. (1^{er} Colloque International sur les Methodes Vectorielles et Paralleles en Calcul Scientifique (1st International Colloquium on Vectorial and Parallel Methods in Scientific Calculations), Paris, France, 17-18 March 1983).
Outlines the uses of the Fast Fourier Transform in numerical weather prediction models, and how the algorithm is most efficiently implemented on vector computers. On the Cray-1, it is sufficient to perform a number of transforms in parallel, but on the Cyber 205 a more complicated approach is necessary in order to achieve maximum efficiency. Multiple FFT packages have been developed on both machines, using a version of the algorithm specialized for real data. Timings are given for the Cray-1, and for both 64-bits and 32-bits arithmetic on the Cyber 205. (16 refs.)

69269 Diagnostic analysis and spectral energetics of a blocking event in the GLAS climate model simulation. Tsing-Chang Chen (Dept. of Earth Sci., Iowa State Univ., Ames, IA, USA), J.Shukla.
Mon. Weather Rev. (USA), vol.111, no.1, p.3-22 (Jan. 1983).
Examines diagnostically the structure and spectral energetics of an amplified persistent blocking ridge and trough pattern that occurred in one of the GLAS climate simulations. This particular model simulation was performed by Shukla and Bangaru (1979) to study the sensitivity of the quasi-stationary waves to the North Pacific sea surface temperature anomalies. The spectrally filtered Hovmoller diagram shows that wavenumbers 2 and 3 in the anomaly run become stationary near their climatological locations. The constructive interference of wavenumbers 2 and 3 forms two persistent blocking ridges: one in the west coast of North America and the other in western Europe. Spectral energetics analysis of this blocking case shows that A_2 and A_3, the available potential energy of wavenumbers 2 and 3, are supplied by the conversion from zonal available potential energy. K_2 and K_3, the kinetic energy of these two waves, are maintained by different processes: K_2 is maintained by conversion from A_2 to K_2, a baroclinic process, while K_3 is mainly maintained by conversion from K_Z, the zonal kinetic energy, to K_3, a barotropic process. (31 refs.)

69270 The relationship between convective adjustment, Hadley circulation and normal modes of the ANMRC spectral model. K.Puri (Australian Numerical Meteorology Res. Centre, Melbourne, Victoria, Australia).
Mon. Weather Rev. (USA), vol.111, no.1, p.23-33 (Jan. 1983).
By expanding model forecasts with and without convection in terms of three-dimensional normal mode functions it is shown that convective adjustment mainly influences gravity modes for vertical mode 4 of the nine-level ANMRC spectral model. It is also shown that the dominant influence of convective adjustment occurs in the lowest frequency gravity modes for all zonal wavenumbers and in particular wavenumbers 0 to 8. By applying various gravity mode filters it is shown that the Hadley circulation in this model is also dominated by these low-frequency gravity modes. (11 refs.)

69271 Vertical differencing of the primitive equations in sigma coordinates. A.Arakawa, M.J.Suarez (Dept. of Atmospheric Sci., Univ. of California, Los Angeles, CA, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.34-45 (Jan. 1983).
A vertical finite-difference scheme for the primitive equations in sigma coordinates is obtained by requiring that the discrete equations retain some important properties of the continuous equations. A family of schemes is derived whose members conserve total energy, maintain an integral constraint on the vertically integrated pressure gradient force, have a local differencing of the hydrostatic equation, and give exact forms of the hydrostatic equation and the pressure gradient force for particular atmospheres. The proposed scheme is a member of this family that in addition conserves the global mass integral of the potential temperature under adiabatic processes. (10 refs.)

69272 Statistical field significance and its determination by Monte Carlo techniques. R.E.Livezey, W.Y.Chen (NOAA, Washington, DC, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.46-59 (Jan. 1983).
The effects of number and interdependence in evaluating the collective significance of finite sets of statistics are frequently non-trivial, especially for spatial networks of time-averaged meteorological data. These effects can be taken into account in two steps: by first prescreening for significance assuming data independence and then, if necessary, by taking into consideration dependence through the use of estimated effective degrees of freedom and the binomial distribution or, failing that, Monte Carlo simulation. Seasonal averages of 700 mb height data are used to illustrate the problem and to demonstrate how the data set properties are taken into account. (28 refs.)

69273 On the nonlinear versus linearized low boundary conditions for topographically forced stationary long waves. Ka Kit Tung (Dept. of Math., MIT, Cambridge, MA, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.60-6 (Jan. 1983).
For quasi-geostrophic stationary long waves forced by topography, the nonlinear lower boundary condition is derived in terms of the geopotential height and compared with the linearized version. The common practice of replacing terms describing the flow over and around a mountain by upstream zonal flow over the mountain and evaluating the resulting condition at sea level is found to be a good approximation for the cases considered and does not need to be modified as sometimes suggested. Specifically, it is found that this approximation does not affect, for most cases, the lower boundary condition expressed in terms of the geopotential height provided that the stationary wave is not near resonance. At resonance, the eddy advection terms may become important for large-amplitude waves when dissipation and surface diabatic heating are taken into account. (11 refs.)

69274 Numerical modeling of diurnal convergence oscillations above sloping terrain. J.Paegle, D.W.McLawhorn (Dept. of Meteorology, Univ. of Utah, Salt Lake City, UT, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.67-85 (Jan. 1983).
Documents the development and sensitivity testing of a numerical model designed to predict diurnal cycles of boundary-layer flows of synoptic horizontal scale above sloping terrain. This application requires detailed vertical resolution of low-level jets, mixed layers and sharp inversions above terrain with large pointwise variations. Tha truncation arrors of tha prassura gradiant term are of special concern. This term is computed using a thermodynamic state carried as a deviation from a standard state. Turbulent mixing is based upon a simplified diagnostic treatment. The final model produces rather stable solutions because of the rather careful pressure gradient calculation and strong physical dissipation. (31 refs.)

69275 The monsoon over the Indian Ocean during summer 1975. II. Break and active monsoons. D.Cadet (Dept. of Meteorology, Florida State Univ., Tallahassee, FL, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.95-108 (Jan. 1983).
For pt.I see ibid., vol.109, p.148-58 (1981). Examines the active and break cycle of the monsoon during summer 1975. The time evolution of the flow over the Arabian Sea shows that three main accelerations of the circulation occurred during the 1975 monsoon. The circulation over the Arabian Sea responds more to the pressure difference between the Mascarene High and the monsoon trough than to pressure changes over central India alone. The intensity of the trade winds in the south Indian Ocean is also significantly positively correlated to the interhemispheric pressure gradient. The establishment of the strong circulation associated with the onset is followed with a lag of 2-3 days by a temperature drop [air temperature and sea surface temperature (SST)] of about 2°C. There is a significant positive correlation between the intensity of the wind over the Arabian Sea and monsoon activity over central India. Break conditions are associated with a weak interhemispheric pressure gradient, decrease of the wind intensity, and increase of SST over the Arabian Sea. During the 1975 summer monsoon, these variations of the monsoon activity related to the break and active cycles occur about every 30 days and affect a large part of the Indian Ocean. (25 refs.)

69276 Foreshadowing northeast monsoon rainfall over Tamil Nadu, India. O.N.Dhar, P.R.Rakhecha (Indian Inst. of Tropical Meteorology, Pune, India).
Mon. Weather Rev. (USA), vol.111, no.1, p.109-12 (Jan. 1983).
The association between the southwest and northeast monsoon (October-December) rainfall over Tamil Nadu has been examined for the 100-year period from 1877 to 1976. A correlation analysis between the two rainfall series revealed that the southwest monsoon (June-September) rainfall is negatively correlated with that of the northeast monsoon rainfall. That is, an excess of deficit of southwest monsoon rainfall over this region is generally followed by an opposite tendency in the northeast monsoon rainfall. A χ^2 test of dependence further indicated that the rainfalls in the two monsoons are not independent of each other. The negative rainfall relationship can be a useful tool in foreshadowing the northeast monsoon rainfall over Tamil Nadu, which is of considerable economic importance for this region. (3 refs.)

69277 Monsoon and teleconnection variability over Australasia during the Southern Hemisphere summers of 1973-77. R.J.Allan (Dept. of Geography, Univ. of Adelaide, Adelaide, Australia).
Mon. Weather Rev. (USA), vol.111, no.1, p.113-42 (Jan. 1983).
Interactions between monsoon and teleconnection circulations over the greater Australasian region 35°N-35°S, 85°E-175°E, are observed in 850 and 200 mb monthly mean velocity potential (χ) and streamfunction (ψ) fields during the peak of the Southern Hemisphere summers (January and February 1973-77) prior to the Winter Monsoon Experiment (WMONEX). Aspects of the spatial and temporal structure of the Australasian monsoon and teleconnection systems are presented through a closer examination of the January 1973-75 sub-period, using vertical cross sections of monthly mean divergence and monthly mean surface streamfunction (ψ_{sfc}) fields. Most importantly, this study suggests that large-scale Southern Oscillation/Walker Circulation (SO/WC) teleconnection patterns are associated with variations in components of the Asian monsoon system. Interannual and intraseasonal fluctuations in the Near Equatorial Troughs of the Northern (NET_{NH}) and Southern (NET_{SH}) Hemispheres appear to be related to large-scale atmospheric circulation changes. (70 refs.)

69278 Relationships among the stratospheric and tropospheric zonal flows and the Southern Oscillation. R.S.Quiroz (NOAA, Washington, DC, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.143-54 (Jan. 1983).
Relationships among the high-latitude stratospheric zonal wind, the tropospheric zonal wind in the region of the subtropical jet and over the equator, the Southern Oscillation, and the stratospheric tropical quasi-biennial oscilla-

tion (QBO) were examined from monthly anomaly data for 13 years (1968-80). Patterns of correlation were found which are broadly consistent with the theory on vertical and latitudinal Rossby wave propagation, with high correlations diminishing rapidly in association with easterly basic flow. Lag correlations as high as 0.8-0.9 were found for leads of ~1-7 months, based on three-month average anomalies for successive months. The simplified lead path is from Southern Oscillation to equatorial winds to subtropical winds to stratospheric high-latitude winds. Relationships involving the QBO appear weak compared with those involving the extratropical flows, the tropospheric equatorial flow of the east Pacific, and the Southern Oscillation. (30 refs.)

69279 Autocorrelation of Northern Hemisphere geopotential heights. D.S.Gutzler, K.C.Mo (Goddard Space Flight Center, NASA, Greenbelt, MD, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.155-64 (Jan. 1983).
Local autocorrelation statistics for the Northern Hemisphere geopotential height field are presented for different seasons and tropospheric pressure levels. The largest one-day lag autocorrelation values are observed over the polar regions and eastern oceans. Well-defined minima exist off the east coasts of Asia and North America. The minima are most distinct in winter, and are shifted northward and weaker during summer. Otherwise, the pattern does not change drastically with season. These geographical patterns do not change much with height, but the minima are less sharply defined at upper tropospheric levels. At longer lags, the extratropical maxima remain distinct, but the minima shift westward over the continents and cover a broader area, as the autocorrelation approaches zero with increasing lag. Values remain high over the tropics, where height anomalies tend to persist for many days. (13 refs.)

69280 The seasonal cycle over the United States and Mexico. V.E.Kousky, S.Srivatsangam (Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Inst. de Pesquisas Espaciais, Sao Paulo, Brazil).
Mon. Weather Rev. (USA), vol.111, no.1, p.165-71 (Jan. 1983).
The annual cycle occupies a unique position in the spectra of meteorological time series. This cycle and its first three harmonics are extracted from the series as a seasonal cycle. The distributions of the annual and seasonal cycles are studied for the United States and its immediate surroundings, using four years of data. The results show that the annual and seasonal cycles are extremely important contributors to the observed temperature and wind fields at the 850, 500 and 250 mb levels. In winter, the annual cycle establishes a west wind maximum in the subtropics, quite akin to the winter-average jet stream. The annual cycle in the horizontal wind constitutes a trough over the central parts of the United States in winter and a ridge in the same area in summer. (11 refs.)

69281 Variability of temperature in Wisconsin. W.A.R.Brinkmann (Dept. of Geography, Univ. of Wisconsin, Madison, WI, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.172-80 (Jan. 1983).
Daily maximum and minimum temperatures since 1897 at three stations in Wisconsin are examined, and the hypothesis is tested that there is no association between interdiurnal or interannual temperature and either the local mean temperature or an estimate of the hemispheric temperature. The hypothesis had to be accepted for interannual variability; it had to be rejected for interdiurnal variability. The association between interdiurnal variability and mean temperature is negative for winter and positive for summer, which is due to Wisconsin's location with respect to the general circulation patterns. (23 refs.)

69282 Two severe freezes in Brazil: precursors and synoptic evolution. M.A.Fortune, V.E.Kousky (Conselho Nacional de Desenvolvimento Cientifico e Tecnologico, Inst. de Pesquisas Espaciais, Sao Paulo, Brazil).
Mon. Weather Rev. (USA), vol.111, no.1, p.181-96 (Jan. 1983).
Two freezes struck Brazil in recent years, one during FGGE in 1979, the other in 1981. Data from multiple sources including satellites and drifting buoys were analyzed for early warning signs and synoptic evolution of the freeze events. Two important precursors were found: (1) a slowly moving low-wave pattern in the central South Pacific Ocean amplified greatly one to two days before frontogenesis in South America and four to five days before the freezes in Brazil; (2) the long-wave ridge, when at maximum amplitude, was located near the southern Andes, and the next long-wave trough downstream was located in the South Atlantic at the longitude of Brazil. This configuration channeled subantarctic air northward entirely over land into subtropical altitudes. (19 refs.)

69283 Surface signatures of a dry nocturnal gust front. R.W.Scott, B.Ackerman (Illinois State Water Survey, Champaign, IL, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.197-204 (Jan. 1983).
Sudden changes in surface meteorological parameters were observed to propagate across a densely-instrumented network in central Illinois during a summer night in 1979. The changes were due to the outflow from an eastward moving, organized storm system passing well north of the network. Although no precipitation was observed within 45 km of the area (i.e. its passage across the network was 'dry'), the change from ambient to outflow air was seen in other surface weather indicators nearly 100 km south of the point at which the outflow is estimated to have been initiated and more than 3 h after the generating storm had dissipated. (7 refs.)

69284 Numerical simulation of the airflow over Lake Michigan for a major lake-effect snow event. M.R.Hjelmfelt (Nat. Center for Atmospheric Res., Boulder, CO, USA), R.R.Braham,Jr..
Mon. Weather Rev. (USA), vol.111, no.1, p.205-19 (Jan. 1983).
A mesoscale model is used to simulate the airflow over Lake Michigan for the major lake-effect snowstorm of 10 December 1977. This storm was characterized by a land breeze circulation and a narrow shore-parallel radar reflectivity band. The model successfully simulated the major atmospheric circulation features including a mesoscale low pressure center and a land breeze front. The model also captured the general character of the observed precipitation pattern which was typified by a narrow band of heavy precipitation along the eastern shore of Lake Michigan. Further simulations were made to examine the effects of latent heat release, lake surface temperature distribution and model grid resolution upon the simulation. (17 refs.)

69285 A concentrated outbreak of tornadoes, downbursts and microbursts, and implications regarding vortex classification. G.S.Forbes (Dept. of Meteorology, Pennsylvania State Univ., University Park, PA, USA), R.M.Wakimoto.
Mon. Weather Rev. (USA), vol.111, no.1, p.220-35 (Jan. 1983).
A remarkable case of severe weather occurred near Springfield, Illinois, on 6 August 1977. Aerial and ground surveys revealed that 17 cyclonic vortices, an anticyclonic vortex, 10 downbursts and 19 microbursts occurred in a limited (20 km×40 km) area, associated with a bow-shaped radar echo. About half of the vortices appeared to have occurred along a gust front. Some of the others appear to have occurred within the circulation of a mesocyclone accompanying the bow echo, but these vortices seem to have developed specifically in response to localized boundary-layer vorticity generation associated with horizontal and vertical wind shears on the periphery of microbursts. Some of these vortices, and other destructive vortices in the literature, do not qualify as tornadoes as defined in the Glossary of Meteorology. A more pragmatic definition of a tornado is suggested. (73 refs.)

69286 Consistent balanced models in bounded and periodic domains. P.R.Gent, J.C.McWilliams (Nat. Center for Atmospheric Res., Boulder, CO, USA).
Dyn. Atmos. & Oceans (Netherlands), vol.7, no.2, p.67-93 (March 1983).
An analysis is made of a family of balanced models which are intermediate in physical content and complexity between the primitive equations and quasigeostrophy. The family is based on the linear balance equations and balance equations, and is characterized by truncations of the full vorticity and divergence equations that retain a global energy invariant. Consistent initial boundary value problems for this family of models are derived, and various aspects of numerical balanced model design are discussed. (33 refs.)

69287 Rossby wave propagation in a barotropic atmosphere. D.J.Karoly (Australian Numerical Meteorology Res. Centre, Melbourne, Victoria, Australia).
Dyn. Atmos. & Oceans (Netherlands), vol.7, no.2, p.111-25 (March 1983).
The ideas of ray tracing from geometrical optics and wave propagation in a slowly varying medium are applied to Rossby waves propagating in a barotropic atmosphere. The propagation of low-frequency Rossby waves in a zonally symmetric base state is compared with that for stationary waves presented by Hoskins and Karoly (1981). These ideas are then used to study the propagation of Rossby waves in a basic state with zonally varying middle latitude or low latitude jets. Conditions which allow cross-equatorial wave propagation are presented. (13 refs.)

69288 On low-order non-linear stochastic-dynamic systems. A.Wiin-Nielsen (World Meteorological Organization, Geneve, Switzerland).
Tellus Ser. A (Sweden), vol.35A, no.1, p.1-16 (Jan. 1983).
A low-order system of equations derived from the advective equation with forcing and dissipation is investigated. A stochastic-dynamic treatment of these equations based on the closure assumption of the neglect of third and higher moments is carried out. For this system, the steady states, including those created by the closure assumption, are determined, and their linear stability properties are found. The asymptotic solutions in a stochastic-dynamic sense are determined without any closure assumption. It is shown that the three stable states for the system with closure form a subset of the continuum of asymptotic states for the system without closure. Several examples showing the differences between the asymptotic solutions of the two systems are calculated. (3 refs.)

69289 Linear non-divergent mass-wind laws on the sphere. R.Daley (Nat. Center for Atmospheric Res., Boulder, CO, USA).
Tellus Ser. A (Sweden), vol.35A, no.1, p.17-27 (Jan. 1983).
The properties of three types of linear non-divergent mass-wind laws on the sphere are examined: linear-balance equation, spherical harmonic expansions of the linearized primitive equations, and Rosby-Hough expansions. Both the symmetric and antisymmetric non-zonal cases are examined. The results show that all three methods are virtually equivalent for the antisymmetric case, but differ considerably for the symmetric case. All three methods, whether derived from the primitive equations or from a filtering approximation, appear to be singular at the equator in the symmetric case. (15 refs.)

69290 On the effect of model resolution on numerical simulation of blocking. S.Tibaldi, L.R.Ji (European Centre for Medium Range Weather Forecasts, Reading, England).
Tellus Ser. A (Sweden), vol.35A, no.1, p.28-38 (Jan. 1983).
A numerical case study of blocking is discussed briefly. The results indicate that model resolution seems to play a major role in the success of the simulation. It is argued that the effect of the initial conditions is somewhat less important than normally considered. The model used for all the experiments is the ECMWF spectral model. (12 refs.)

69291 The atmospheric energy budgets over North America, the North Atlantic and Europe based on ECMWF analyses and forecasts. H.Savijarvi (European Centre for Medium Range Weather Forecasts, Reading, England).
Tellus Ser. A (Sweden), vol.35A, no.1, p.39-59 (Jan. 1983).
The kinetic energy, sensible heat and latent heat budgets and the total energy balance of the Earth-atmosphere system are studied over North America, the North Atlantic and Europe. The data consist of 1 year (December 1979-November 1980) of ECMWF initialized objective grid point σ-coordinate analyses and the ensemble of forecasts for day 3. The results quantitatively confirm the thermally direct meridional circulation over North America with generation of kinetic energy and adiabatic heating in the troposphere; kinetic energy and sensible heat are exported out of the region. The opposite holds for the North Atlantic area. Budgets from the forecast data reproduce the main features present in the analysed data, but also indicate some defects in the parametrization of the sub-grid scale processes in the ECMWF model. (37 refs.)

69292 Statistical predictability and spectra of air temperature over the Northern Hemisphere. V.E.Privalsky (Water Problems Inst., Acad. of Sci., Moscow, USSR).
Tellus Ser. A (Sweden), vol.35A, no.1, p.51-9 (Jan. 1983).
Parametric models and statistical predictability of mean annual air temperature, both at individual stations (MAAT) and zonally averaged (MZAT), are evaluated. The time series have lengths from 125 to 315 years for MAAT and 86 years (1891-1976) for MZAT. The optimal parametric models of MAAT are shown to be closely approximated by a first-order Markov sequence with a small characteristic time scale, so that their statistical predictability is minimal. Variations in MZAT should be described with more complicated models; the limits of statistical predictability amount to between 4 and 5 years. The temperature spectra are estimated. (20 refs.)

69293 Some characteristics of chemical precipitation. A.W.Hogan (Atmospheric Sci. Res. Center, State Univ. of New York, Albany, NY, USA).
Tellus Ser. B (Sweden), vol.35B, no.2, p.121-30 (April 1983).
Two very dissimilar cold frontal occlusions deposited 6 mm and 60 mm of rain respectively at an observatory in the rural northeastern USA. Water precipitation was carefully observed, in conjunction with other meteorological parameters, through both storm systems. The concentration of several ionic substances were measured in specimens of rain water collected during meteorologically homogeneous portions of the two storms. The rate of chemical precipitation was determined with respect to water precipitation. (13 refs.)

69294 An investigation of the atmospheric HNO_3-NH_3-NH_4NO_3 equilibrium relationship in a cool, humid climate. R.M.Harrison, C.A.Pio (Dept. of Environmental Sci., Univ. of Lancaster, Lancaster, England).
Tellus Ser. B (Sweden), vol.35B, no.2, p.155-9 (April 1983).
Simultaneous measurements of gaseous nitric acid and ammonia were made during summer, autumn and winter months in North-West England. Concentrations of HNO_3 and NH_3 lay within the ranges 0.03-0.36 ppb and 0.9-5.1 ppb respectively, gaseous HNO_3 accounting for only about 12% of total

nitrate. Under the high humidity conditions prevalent during the work, the concentration data are consistent with the equilibrium of gaseous HNO_3 and NH_3 with solution droplets of NH_4NO_3. (18 refs.)

69295 Dynamics of singular geostrophical vortices in a two-level model of the atmosphere (ocean). V.M.Gryanik.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.227-40 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The equations are obtained for singular geostrophical vortices interactions with each other and with a regular current. In the framework of a model the interaction peculiarities are analysed in a baroclinic atmosphere (or ocean) as well as in a baroclinic atmosphere-ocean system. The dynamics of two singular geostrophical vortices is considered for two cases: (i) without a regular current and (ii) in a current with zonal constant potential vortex. The influence of some non-adiabatic factors on vortices evolution is discussed. On the base of the model the analysis has been made of the relative motion of double tropical vortices. (23 refs.)

69296 Kinetic model of waterless fine-dispersed aerosol of the troposphere. G.V.Rozenberg.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.241-54 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
A model of kinetically caused parameters of the tropospherical fine-dispersed aerosol for stationary conditions is described. The model has two external parameters. (5 refs.)

69297 Numerical simulation of thermal influence on convective cloud development. A.S.Kabanov, A.Ye.Klykov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.274-81 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Numerical solutions of thermohydrodynamic equations with varying eddy coefficient have been used to study various structures of a convective cloud with conditionally stable stratification above a layer of thermal energy accumulation. More than sixty numerical experiments with different periods of appearance of thermals have been carried out. The life duration as well as the size of a cloud grow and its lower boundary rises under the influence of individual successive thermals. Water content distribution becomes bimodal with height and a clearance appears in a convective cloud. The experimental results have been compared with the observations. (14 refs.)

69298 Current progress and prospects in numerical techniques for weather prediction models. M.J.P.Cullen (Forecasting Res. Branch, Meteorological Office, Bracknell, England).
J. Comput. Phys. (USA), vol.50, no.1, p.1-37 (April 1983).
Progress in numerical weather prediction since about 1977 is reviewed. The development of larger and faster computers now allows a global forecast to be made in three minutes per day using a 150 km grid in the horizontal, 15 levels in the vertical, and one of the very efficient integration schemes now available. The forecasts produced are useful guidance to forecasters to about four days on average, but there is a large difference in performance from case to case. In this review developments in understanding the solutions to the governing equations are discussed, some of the efficient integration schemes are described in detail, and an example of the current standard of forecasts is displayed. (74 refs.)

69299 Explorative studies of meso- and micro-scale systems and lee waves over Qomolangma Feng (Mount Everest). Gao Dengyi, Liu Zengji, Yan Liangzheng (Inst. of Astropheric Phys., Acad. of Sinica, Beijing, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.12, p.1305-9 (Dec. 1982).
The existence of meso- and micro-scale systems at an elevation of 7500-9500 m during the exploration of Mt. Qomolangma in May 1975 was made known. And it seems, from the conditions they cause, that there is a relationship between the meso- and micro-scale systems and the lee waves. To study this relationship, investigations by free balloons were made on the north side of Mt. Qomolangma in April 1980. The conclusion shows that there are certainly strong lee waves there, corresponding to the atmospheric conditions caused by the meso- and micro-scale systems. (no refs.)

69300 Extreme value analysis in meteorology. R.C.Tabony (Meteorological Office, Bracknell, England).
Meteorol. Mag. (GB), vol.112, no.1329, p.77-98 (April 1983).
The theory of extreme values assumes that maxima (or minima) are drawn from infinitely large samples of independent observations belonging to a single population. Failure to satisfy the theory, therefore, can be due to using too small a sample or to the inclusion of observations from more than one population. It is demonstrated that in meteorology these reasons are often alternative expressions of the same problem, namely lack of data. A series of extremes may be regarded as belonging to the same population if a single forcing factor is responsible for the whole range of extremes encountered. This is seldom true of meteorological variables. It is shown that analyses of annual extremes are commonly to be preferred to those based on monthly data. When observed extremes fall well short of a physically imposed upper limit it is suggested that they can appear to be unbounded above. For short duration rainfall this can be interpreted as being due to changes in the organizational structure of convective storms from the lesser to the greater extremes. (17 refs.)

69301 Forecasting urban minimum temperatures from rural observations. J.Roodenburg (Royal Netherlands Meteorological Inst., de Bilt, Netherlands).
Meteorol. Mag. (GB), vol.112, no.1329, p.99-106 (April 1983).
A regression formula has been derived from which the nocturnal minimum temperatures in an urban area may be computed from meteorological variables observed at a nearby airport. (4 refs.)

69302 Turbulence with a spectral gap. A.Pouquet, U.Frisch (CNRS, Obs. de Nice, Nice, France), J.P.Chollet.
Phys. Fluids (USA), vol.26, no.4, p.877-80 (April 1983).
Under what conditions turbulent motions produced by two different mechanisms can coexist and have energy spectra separated by a gap, as often observed in astro- and geophysical flows, are investigated. The dynamical consistency of such a gap is illustrated using a two-point statistical closures and some experiments are suggested. (12 refs.)

69303 Measurement of daylight UVA in Glasgow. H.Moseley, M.Davison (Dept. of Clinical Phys. & Bio-Engng., West of Scotland Health Boards, Glasgow, Scotland), R.M.Mackie.
Phys. Med. & Biol. (GB), vol.28, no.5, p.589-7 (May 1983).
Measurements of daylight UVA have been carried out in Glasgow using a UVA-band detector and a spectroradiometer, both with the aperture window horizontal. Daily energy densities, defined as the total UVA energy each day per unit area, were obtained for the period November 1980 to May 1982. Levels rose from a mean December daily energy density of 4 J cm^{-2} to an average of 69 J cm^{-2} in June, with considerable fluctuations from day to day and with up to seven-fold changes observed on consecutive days. The UVA level sometimes varied rapidly during the day, with differences of up to a factor of six in successive 10 min periods. The daily temporal distribution of UVA for summer and winter, and the measured daylight spectra are presented. Measurements made by the spectroradiometer were compared with earlier published findings of solar UVA doses received by 56 patients who were photosensitised by 8-MOP in the course of PUVA therapy. It is shown that the median dose represented only 12 min daylight exposure and this indicates that the majority of patients do take care to avoid unnecessary exposure. However, the maximum dose was equivalent to some 84 min exposure to daylight UV and so there is clearly scope for a considerable reduction in exposure in some cases. (12 refs.)

69304 Latitudinal and vertical variation of thermodynamic instability over India as revealed by MONEX 1979. D.V.Viswanadham, M.R.Rameshkumar (Dept. of Marine Sci., Univ. of Cochin, Cochin, India).
Proc. Indian Natl. Sci. Acad. Part A, vol.48, no.6, p.567-72 (Nov. 1982). [received: April 1983]
The static stability parameters σ_d and σ_m for dry air and moist air respectively which give a direct insight into the vertical variation of stability, have been computed, besides mixing ratio for select Indian stations situated in different latitude belts, by making use of the 2030 hr observations of MONEX 1979. The study revealed that the atmosphere up to 500 mb is convectively unstable in all latitude belts. The spatial variation of this stability revealed that the central parts are unstable. The middle layer (850-700 mb) is found to be highly unstable compared to other parts. An intercomparison for different months is made and discussed. (2 refs.)

69305 An estimate of the effect of the space-time coherence disturbances of the signal field on the effectiveness of optical communication lines in the atmosphere. Ye.R.Milyutin, Yu.I.Yaremenko.
Radio Eng. & Electron. Phys. (USA), vol.27, no.6, p.1-9 (June 1982). Translation of: *Radiotekh. & Elektron. (USSR),* vol.27, no.6, p.1057-66 (June 1982). [received: May 1983]
It is well known that the state of the medium of propagation of theoretical radiation is the basic factor which determines the effectiveness of atmospheric optical communication lines (AOCL). Until the present time the effect of signal attenuation caused by various meteorological conditions on the AOCL performance has been investigated quite thoroughly, but such a statement is not quite true for the effect of space-time coherence disturbances of the signal field, caused by turbulence. The authors present a comparative analysis of the effectiveness of AOCL, which use different forms of modulation and different methods for reception of optical radiation, as a function of atmospheric turbulence parameters. (10 refs.)

69306 Dynamics of the middle atmosphere. M.A.Geller (Lab. for Planetary Atmosphere, NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Space Sci. Rev. (Netherlands), vol.34, no.4, p.359-75 (April 1982). [received: April 1983] (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
It is demonstrated by means of model calculations that while the general configuration of middle atmosphere dynamics (i.e. winter westerlies and summer easterlies) is determined by differenial solar heating, the deviations of the zonally-averaged temperature field from radiative equilibrium and the closure of the jet structures with increasing altitude results from the action of zonal mean momentum dissipation processes. The apparent heating and acceleration of the mean zonal state by planetary wave heat and momentum fluxes are examined using a Eulerian framework, and it is demonstrated that these are overestimates of their net effect. It is argued that since decelerations of the mean zonal flow are required in both winter and summer, and planetary waves are known to be very weak in the summer middle atmosphere, gravity waves are probably responsible for most of the middle atmosphere momentum dissipation as a result of their attenuation with height above their wave breaking altitude. (20 refs.)

69307 Circulation and waves in the middle atmosphere in winter. T.Matsuno (Geophys. Inst., Univ. of Tokyo, Tokyo, Japan).
Space Sci. Rev. (Netherlands), vol.34, no.4, p.387-96 (April 1982). [received: April 1983] (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
A few topics concerning the dynamics of the circulation and waves in the middle atmosphere are reviewed. The Lagrangian-mean descriptions of waves and wave-mean flow interactions developed in recent years give new views on the general circulation of the lower stratosphere and the mechanism of a sudden warming. In the former problem, the classical Brewer-Dobson circulation model is revived as the Langrangian-mean circulation which is directly connected with transports of long-lived trace species. In the latter problem, the easterly acceleration by planetary waves is understood in terms of the form drag through undulating material surfaces. This effect is nearly identical with the Eliassen-Palm flux, which is now used as a powerful tool to diagnose detailed mechanism of sudden warmings on individual event basis. Preliminary result of the author's numerical experiment to model sudden warmings caused by a variable planetary wave forcing in the troposphere is presented. (27 refs.)

69308 Influence of upper-level clouds on the thermal regime and circulation of the atmosphere. E.P.Borisenkov, V.P.Meleshko, A.P.Sokolov (Main Geophys. Obs., USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.1-10 (1981). Translation of: *Meteorol. & Gidrol. (USSR),* no.11, p.5-17 (1981).
The sensitivity of the Earth-atmosphere radiation balance to clouds at various levels is investigated. Numerical experiments are performed using a general atmospheric circulation model without upper-level clouds. Formation of clouds in an anticyclonic disturbance is reproduced. Variations governed by clouds and the thermal regime and circulation of the atmosphere are analyzed in detail. (23 refs.)

69309 Calculation of wind velocities in gusts in narrow cold-front zones. M.A.Masterskikh (Hydrometeorological Sci. Res. Center, USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.76-8 (1981). Translation of: *Meteorol. & Gidrol. (USSR),* no.11, p.93-4 (1981).
The physical conditions that correspond to intensification of wind in narrow (up to 50 km) zones of cold fronts are examined. Formula are given for estimation of wind velocities in gusts in narrow frontal zones. (9 refs.)

69310 Dependency of tropospheric attenuation versus frequency and distance on radio relay links with optical sight. J.Kerhart, U.Kuhn, S.Ogulewicz.
Tech. Mitt. RFZ (Germany), vol.27, no.1, p.18-21 (March 1983). In German.
Within the framework of cooperation between the CSSR, the Polish People's Republic and the GDR, measurements of troposphere-dependent attenuation on radio relay links of differing length at the frequencies 3.5 GHz, 6 GHz and 11 GHz were made. Curves for tropospheric attenuation probability have been deduced. Deviations from CCIR data for 4 GHz over north-west Europe occur where greater distances are involved. (29 refs.)

69311 Atmospheric biopollutants of Gorakhpur. R.N.Tripathi, N.K.Dubey, S.N.Dixit (Dept. of Botany, Univ. of Gorakhpur, Gorakhpur, India).
Water, Air & Soil Pollut. (Netherlands), vol.19, no.3, p.215-21 (April 1983).
The present study on atmospheric biopollutants in the vicinity of Gorakhpur was carried out from July 1979 to June 1981 by exposing adhesive slides. Pollen grains, fungal spores and organic matters were found to be maximum amongst the traps. Plant parts (floral parts, hairs, pollens, tissue segments), algal parts; animal parts (danders, insects with pollen, insect eggs, legs, mouthparts, scales, spicules, wings) and identified and unidentified organic parts loaded with bacteria/fungi were found in the air throughout the year. Diurnal, monthly and seasonal variations in atmospheric biopollutants were studied quantitatively. The study of diurnal periodicity revealed maximum trapping of air-borne particles during morning and noon. The particles were maximum during the transition periods of the seasons (during mid October to mid November and March) and a minimum in June and August. The intensity of biopollutants increased with wind velocity and decreased with rainfall. (10 refs.)

69312 Wind tunnel simulation of the wind in an urban environment. K.W.Rutledge.
Report OUEL-1414/82, Univ. Oxford, England (July 1982), 20 pp.
Describes a part-depth simulation of an urban flow ($Z_0=1.0$ m) developed by the Wind Engineering Research Group in the Oxford University 4 m×2 m industrial aerodynamics tunnel. The velocity characteristics of the resulting simulation are investigated. (6 refs.)

69313 Cloud classification on multispectral images taken from meteorological satellites. G.Seze, M.Desbois, S.Senesi (Ecole Polytech., Palaiseau, France).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.87-92 vol.1 In French.
The dynamic cloud cluster method is applied to the spectral representation of image segments from meteorological satellites (which are furnishing pictures at 2, 3 or N wavelengths). In the case of METEOSAT, the resulting classifications are meteorologically significant, for mesoscales as well as for large scale. In this last case, the method can be applied to provide initial cloudiness parameters for an atmospheric general circulation model. (no refs.)

69314 Some tropospheric factors affecting the reliability of microwave LOS links over Northern India. S.K.Sarkar, H.N.Dutta, B.M.Reddy (Radio Sci. Div., Nat. Phys. Lab., New Delhi, India).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.294-7 part 2
Discusses how the predominance of any particular microwave propagation mode depends upon the radio frequency; the path geometry and the structure of radio-refractive index fluctuation of the medium and the propagation characteristics are determined by the dominant mechanism of propagation. According to homogeneous turbulence theory, field strength relative to free space is characterised by $\lambda^{-1/3}$ law. The dual frequency field strength measurements gives more information about propagation mechanisms compared to a single frequency experiment. When the mechanism of propagation is known and association of refractive index fluctuations and wind velocity component along the propagation path are determined, it is possible to interpret the characteristics of fading patterns from the knowledge of meteorological elements. (12 refs.)

69315 Accurate modeling of instantaneous solar radiation. C.K.Alexander, R.Z.Makki, R.E.Ohlin (Tennessee Technol. Univ., Cookeville, TN, USA).
IEEE SOUTHEASTCON '83 Conference Proceedings, Orlando, FL, USA, 11-14 April 1983 (New York, USA: IEEE 1983), p.448-52
Presents a simulation model that predicts average instantaneous solar radiation for different localities around the United States. The method differs from previous techniques in that it offers a peaking model rather than just average values. Based upon the results of the simulation, the authors present relationships leading to significant modifications of Laue's curves. The computer simulation presented can be used for any location around the world where monthly average total radiation and hours of sunshine data are available. (5 refs.)

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Annual oceanic heat transports computed from an atmospheric model .... See Entry 69219

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Restitution of atmospheric optical parameters profiles using laser sounding data .... See Entry 69377

A method of construction of a resonator radio refractometer .... See Entry 69385

Solar variability and minor constituents in the lower thermosphere and in the mesosphere .... See Entry 69398

Controlled stimulation of magnetospheric electrons by radio waves: experimental model for lightning effects .... See Entry 69413

92.60S Climatology

69316 Fluctuations in the drought/flood area over India and relationships with the Southern Oscillation. H.N.Bhalme, D.A.Mooley, S.K.Jadhav (Indian Inst. of Tropical Meteorology, Pune, India).
Mon. Weather Rev. (USA), vol.111, no.1, p.86-94 (Jan. 1983).
An objective numerical drought/flood index has been used to obtain, on the dryness side, the Drought Area Index (DAI) and on the wetness side, the Flood Area Index (FAI) for India for the period 1891-1979. The DAI for a given year is the percentage area of India corresponding to a mean monsoon index with drought intensity ≤ -2 (moderate drought or worse). Likewise, on the wetness side, the Flood Area Index (FAI) for the given year is the percentage area of India corresponding to a mean monsoon index with flood intensity $\geq +2$ (moderate flood or worse), where the mean monsoon index of an area is the mean drought/flood index for the four monsoon months (June-September). A year with $DAI/FAI \geq 25$, i.e. 25% of the country area, is identified as a large-scale drought/flood year, respectively. The magnitude 25 used in identifying large-scale drought/flood corresponds approximately to twice the standard deviation of the DAI/FAI series. The large-scale April Pressure Index (PI) of the Southern Oscillation has been devised with the combination of surface pressure of stations from Australia, India, Indonesia and South America. The fluctuations of PI covering a period of 89 years (1891-1979) and its relation to the DAI and FAI have been examined. (30 refs.)

69317 An atmospheric $^{13}C/^{12}C$ reconstruction generated through removal of climate effects from tree-ring $^{13}C/^{12}C$ measurements. S.W.Leavitt, A.Long (Dept. of Geosci., Univ, of Arizona, Tucson, AZ, USA).
Tellus Ser. B (Sweden), vol.35B, no.2, p.92-102 (April 1983).
An accurate reconstruction of past $^{13}C/^{12}C$ ratios of atmospheric CO_2 may provide key constraints on the historical activity of the biosphere as CO_2 source or sink. Tree rings appear to be a repository of this information but there is much noise in the collection of previous reconstructions, presumably associated with site selection, radial variability, choice of representative wood chemical constituent, and subtle effects of climate on fractionation. The authors attempt to avoid these pitfalls and develop a 50-yr $\delta^{13}C_{ATM}$ record from juniper trees (genus Juniperus), in fact, by taking advantage of the influence of climate on fractionation. Trees were harvested from suitable sites in close proximity to weather stations with monthly records of temperature and precipitation, and ring material was separated from the sections in 5-year intervals around their full circumference. From each interval, relationships of $\delta^{13}C$ of the cellulose fraction with mean December temperature or precipitation of the respective sites emerged, showing nearly constant slopes from one interval to the next but with different intercepts. The separation of these regression lines of different intervals is interpreted as the response of the trees to the changing $\delta^{13}C$ of atmospheric CO_2 so that $\delta^{13}C_{ATM}$ curves are constructed from this spacing. (41 refs.)

69318 Dendroclimatological techniques in the study of climate history. A.Kh.Khrgian (Moscow State Univ., Moscow, USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.11-20 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.18-29 (1981).
Discusses certain examples in which climatic events and climate changes in the past influenced annual tree growth. Radiation, temperature, and rainfall variations have noticeable though lagging effects of the increments. Interpretation of dendroclimatic observations may be aided by results of modern instrumental observations and historical accounts. (12 refs.)

69319 An empirical analysis of the influence of CO_2 on contemporary variations in annual average surface air temperature in the Northern Hemisphere. K.Ya.Vinnikov, P.Ya.Groisman (State Hydrological Inst., USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.21-33 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.30-42 (1981).
Presents a nonstationary model of the Northern Hemisphere energy balance that takes account of the thermal lag of the climatic system, albedo variations due to variations of atmospheric transparency, (turbidity), the influence of CO_2 concentration on the longwave outgoing radiation, and feedback between albedo and temperature. The model is used to study variations of the global hemispheric thermal regime from 1883 through 1977. Estimates for the sensitivity of the global surface temperature regime to doubling of CO_2 content in the atmosphere vary from 2 to 3°C, in satisfactory agreement with the most reliable theoretical estimates. (38 refs.)

Sea ice classification from infrared thermometry over the North Water, winter 1980/81 .... See Entry 69252

Foreshadowing northeast monsoon rainfall over Tamil Nadu, India .... See Entry 69276

The paleogeography of Paleozoic and Mesozoic storm depositional systems .... See Entry 69330

92.65 ATMOSPHERIC OPTICS

(see also 42.00 Optics)

69320 Overlapping effect of atmospheric H_2O, CO_2 and O_3 on the CO_2 radiative effect. Wei-chyung Wang, P.B.Ryan (Atmospheric and Environmental Res. Inc., Cambridge, MA, USA).
Tellus Ser. B (Sweden), vol.35B, no.2, p.81-91 (April 1983).
The effect of overlapping of atmospheric H_2O, CO_2 and O_3 absorption bands on the radiation budget perturbation caused by CO_2 doubling is investigated.

Since the effect depends on the amount of gases in the atmosphere as well as on the strength of the absorption bands, the authors examine the effect associated with the variation of gas abundance using a narrow band representation for the absorption bands. This band representation allows for the absorption band structure and thus accounts for the correlation of the spectral feature of the absorbing gases. (40 refs.)

69321 Atmospheric turbidity over Africa—disturbed by the El Chichon eruption?. R.Jaenicke, G.A.d'Almeida (Inst. fur Meteorologie, Univ. of Mainz, Mainz, Germany).
Geophys. Res. Lett. (USA), vol.10, no.3, p.233-5 (March 1983).
In a network, the atmospheric turbidity over Africa is observed for two years. The most recent data from a central Sahara station show increased values but horizontal visibility remained unchanged. This large turbidity seems to be produced not only regionally, rather the temporal development points toward the eruption of El Chichon in Mexico. (11 refs.)

69322 Extinction and scattering of infrared radiation by polydisperse systems of ice plates and cylinders. A.G.Petrushin.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.267-73 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
The extinction, absorption, scattering efficiencies and single albedo are obtained for polydisperse systems of plates and cylinders. The influence of ice particle shape, size, orientation as well as the direction of incident radiation propagation relative to the plane of orientation on these characteristics is studied. The values of extinction, scattering and absorption efficiencies are shown to vary not more than by factor of 2-2.5 at the orientation of ice cylinders and plates as the direction of incident radiation propagation changes relatively to the given plane, whereas the value of single albedo changes by factor of 0.2-0.3. (21 refs.)

69323 Image processing adapted to the atmosphere speckle. I. Speckle formation in turbulent atmosphere. Statistical properties. J.Vernin, M.Azouit (Dept. d'Astrophys., Univ. de Nice, Nice, France).
J. Opt. (France), vol.14, no.1, p.5-9 (Jan.-Feb. 1983).
Reviews the theory of the production of speckle by the diffraction of light waves through turbulent layers seen as phase screens. Different atmospheric situations allow the authors to show the influence of the distance between the diffuser and the observer on the speckle geometry. The small perturbation approximation is experimentally justified and it is shown that the speckle pattern is still contrasted even with broadband photoelectric receivers. Image processing by means of spatiotemporal analysis of a single or multiple star could give one a variety of geophysical information. (11 refs.)

69324 Spatio-temporal study of the point spread function of the terrestrial atmosphere by solar limb observation. P.Druesne (Lab. d'Electricite, Univ. de Pau et des Pays de l'Adour, Pau, France), J.Borgnino, C.Aime, R.Petrov, S.Kadiri.
J. Opt. (France), vol.14, no.1, p.11-17 (Jan.-Feb. 1983). In French.
By solar limb observation the temporal variations of image motion and blurring are studied. Measurements of typical time constants of these parameters are deduced and the results are found in agreement with the lower values obtained by other observers. Comparison with theory leads to the estimation of Fried's parameter r_0 (see J. Opt. Soc. Amer., vol.56, p.1372, 1966). (13 refs.)

69325 Chemical elemental composition of wind-blown dust, April 19, 1980, Beijing. Wang Mingxing (Inst. of Atmospheric Phys., Acad. Sinica, Beijing, China), J.W.Winchester, T.A.Cahill, R.Lixin.
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1193-8 (Nov. 1982). [received: April 1983]
World interest in the long-range transport of dust from dry areas of China to the Pacific and Arctic oceans as well as the possible importance of surface dust as a factor in air quality of North China justifies the investigation of the chemical composition of soil dust in China during periods of dust storm activity. In this paper the first measurements of North China dust composition as a function of particle size for the principal earth crustal elements are reported. The results are evaluated from the standpoints of the constancy of this composition over time and with particle size, effects of sampler inlet design on coarse particle dust concentrations, and the concentrations in various particle size ranges during high-wind conditions as compared with normal quiet air conditions in North China. (12 refs.)

69326 Calculations of the intensity of a partially coherent optical beam in a turbulent atmosphere. V.A.Loginov, V.V.Slonov.
Sov. J. Quantum Electron. (USA), vol.12, no.11, p.1443-6 (Nov. 1982). Translation of: *Kvantovaya Elektron., Moskva (USSR)*, vol.9, no.11, p.2221-5 (Nov. 1982). [received: May 1983]
An investigation of the main energy characteristics of the field of a partially coherent optical beam propagating in a turbulent atmosphere: the beam intensity on the axis and the beam width. It is found that these characteristics depend on the degree of initial spatial coherence of the beam, the turbulent distortions, and the wave parameter. Numerical calculations are made of the spatial distribution of the beam intensity and simple empirical relationships are derived and discussed. (7 refs.)

69327 Certain problems of seeing through clouds and fogs. A.S.Drofa, I.L.Katsev (Inst. of Experimental Meteorology, Acad. of Sci., USSR).
Sov. Meteorol. & Hydrol. (USA), no.11, p.85-95 (1981). Translation of: *Meteorol. & Gidrol. (USSR)*, no.11, p.101-9 (1981).
Theoretical and experimental studies of the visibility of objects through clouds and fogs are reviewed. Relationships are presented for estimation of the optical transfer function of a cloud medium and the signal/noise ratio in the image of an object observed through the medium. The manner in which these characteristics are affected by the light-scattering properties of the cloud medium and their distributions along the line of sight are discussed. (48 refs.)

69328 An analytical model to calculate the atmospheric correction on infrared thermal signals. P.G.Berardi (Istituto di Aerodinamica, Univ. di Napoli, Napoli, Italy).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.329-34 vol.1
Determines the radiative field in the atmosphere with its upwelling, and downwelling components for an absorbing and emitting medium. The atmospheres behaviour in the infrared spectrum is modelled by means of Bignell's formula. The radiative field is obtained in closed form. It is possible, for a given atmosphere, to define an equivalent atmospheric temperature (T_e^a), dependent on the altitude, which allows one to compute the monochromatic intensity with the classical isothermal model. The bounding values of the function T_e^a define three different surface temperature intervals with regards to the atmospheric correction. The model is tested by using meteorological data. (6 refs.)

Quality of upwelling radiance retrieved from Coastal Zone Colour Scanner (CZCS) data for ocean colour determination .... See Entry 69249

An operational program for monitoring surface temperatures of lakes and coastal-zone waters in Canada from polar-orbiting satellite infrared data .... See Entry 69332

An approximate procedure to isolate single scattering contribution to lidar returns from fogs .... See Entry 69338

Restitution of atmospheric optical parameters profiles using laser sounding data .... See Entry 69377

Estimation of the atmospheric path radiance from multispectral infrared images .... See Entry 69388

92.90 OTHER TOPICS IN HYDROSPHERIC AND ATMOSPHERIC GEOPHYSICS

69329 Investigation of remote sensing possibilities of the lower atmosphere in the microwave range and some aspects of statistical data use. K.P.Gaikovich, N.N.Markina, A.P.Naumov, V.M.Plechkov, M.I.Sumin (Radiophys. Res. Inst., Gorky, USSR).
Int. J. Remote Sens. (GB), vol.4, no.2, p.419-31 (April-June 1983).
An integral relation is obtained between variations of the brightness temperature for ground-based microwave radiometry and meteorological parameters of the atmosphere which permits a general approach to the statement of inverse problems of thermal and humidity sensing in the microwave range. Statistical estimations of accuracy for recovering low-altitude temperature and humidity profiles are given. Using the example of ammonia pollution of the atmosphere possibilities are illustrated of remote-sensing methods for the definition of constituents of an industrial origin. Problems are considered for the use of remote-sensing data in real-time monitoring of the astronomical refraction and the electrical path length of the atmosphere in the radio range. (41 refs.)

69330 The paleogeography of Paleozoic and Mesozoic storm depositional systems. K.M.Marsaglia, G.Devries Klein (Dept. of Geology, Univ. of Illinois, Urbana, IL, USA).
J. Geol. (USA), vol.91, no.2, p.117-42 (March 1983).
Present-day hurricane belts are confined to 5°-45° latitude along the western edges of oceans, whereas winter storms occur ubiquitously above 25° latitude. Both hurricanes and winter storms occur between 25° and 45° latitude in some areas. Storm zones can be identified on global paleogeographic maps with the assumption that this latitudinal zonation of storm systems existed in the geological past. Evaluation of 69 previously-recognized Paleozoic and Mesozoic storm depositional systems on such maps shows that only 70% of them occur in ancient hurricane, mixed hurricane and winter storm, and winter storm belts. The remainder occur on the western sides of continents and/or at low paleolatitudes, and therefore well may be of different origin. Mesozoic storm depositional systems containing hummocky stratification tend to occur in counterpart paleo-winter storm belts, whereas hummocky stratification in suggested Paleozoic examples occur in both winter storm and hurricane belts and in paleolatitudes where the authors infer storm activity did not occur. (134 refs.)

69331 Landsat-data for distributed hydrological models. L.Gottschalk, I.Krasovskaia (Dept. of Hydrology, Univ. of Uppsala, Uppsala, Sweden), J.J.Talts.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.407-12 vol.1
The most widely used models in hydrology today are lumped models, but they do not answer sufficiently to the present needs of hydrological information for water resources planning. When model parameters are determined from hydrological and climatological observations with the help of statistical methods, the choice of basin is governed by the pattern of the observation network and not by the needs of a specific water planning problem. Landsat-data are used to make a classification of the basin of one of the largest lakes in Sweden. Landsat-data are then transformed to the map grid system and the two data sets are used together in a maximum-likelihood classification into 34 categories representing water, built up areas, forest, bogs and arable land. The demands of new types of spatial data are discussed as well as methods of data acquisition with examples from a hydrological project in Sweden. (5 refs.)

69332 An operational program for monitoring surface temperatures of lakes and coastal-zone waters in Canada from polar-orbiting satellite infrared data. G.J.Irbe, A.Saulesleja (Atmospheric Environment Service, Downsview, Ontario, Canada).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.717-24 vol.1
Surface temperatures of the Laurentian Great Lakes and Nova Scotia coastal waters in Canada are monitored regularly using infrared radiances in the 10.5-11.5 μm region detected by sensors on board NOAA polar-orbiting satellites. Temperatures are corrected for atmospheric attenuation by radiative transfer calculations, using the Low Resolution Transmission (LOWTRAN) model of Selby et al. (1976), and local radiosonde data for water vapour distribution in the atmosphere. The satellite-derived temperatures have been found to have a root-mean-square difference of 0.6°C from temperatures measured at buoys. The performance of the method under diverse atmospheric conditions is investigated in the course of operational temperature monitoring. (8 refs.)

Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium) .... See Entry 64586

Using midday surface temperature to estimate daily evaporation from satellite thermal IR data .... See Entry 69336

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Landsat-data for distributed hydrological models .... See Entry 69331

An operational program for monitoring surface temperatures of lakes and coastal-zone waters in Canada from polar-orbiting satellite infrared data .... See Entry 69332

The chemistry of geothermal waters in Iceland. III. Chemical geothermometry in geothermal investigations .... See Entry 69371

Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques .... See Entry 69389

93.65 DATA ACQUISITION AND STORAGE

Extreme value analysis in meteorology .... See Entry 69300

93.85 INSTRUMENTATION AND TECHNIQUES FOR GEOPHYSICAL RESEARCH

69333 Water depth mapping from passive remote sensing data under a generalized ratio assumption. J.M.Paredes, R.E.Spero (W.W. Gaertner Research Inc., Stamford, CT, USA).
Appl. Opt. (USA), vol.22, no.8, p.1134-5 (15 April 1983).
Estimating water depth on the basis of measurements taken in a single spectral band can be unreliable due to the confounding effect of variation in bottom type. This can be partially corrected for by including more than one band in the process. Depth processing is based on a reflectance model and if bands exist such that the ratio of the bottom reflectances is the same for all points in the scene, an equation giving depth which is independent of bottom type can be produced. Thus, a generalized version of the assumption that a pair of bands exists such that the ratio of the bottom reflectances in these two bands is the same for all bottom types in the scene is that there exists a pair of band and constants c_1, c_2 such that $(r_{A1})^{c1}(r_{A2})^{c2}=(r_{B1})^{c1}(r_{B2})^{c2}=...=\alpha$ holds for all bottom types in the scene. The authors see how this assumption makes it possible to derive an equation giving depth as a function of light intensity which is valid for all bottom types. Then, the authors take a closer look at the assumption to give a simple condition in which it must hold. (5 refs.)

69334 Electron microscopy of minerals. P.R.Buseck (Dept. of Geology, Arizona State Univ., Tempe, AZ, USA).
Am. Sci. (USA), vol.71, no.2, p.175-85 (March-April 1983).
Transmission electron microscopy allows one to see details of crystals at close to the atomic level, increasing the understanding of the chemical and physical properties of minerals. The author first of all describes the high-resolution transmission electron microscopy method and then provides examples of the new knowledge gained by use of this method. TEM images of asbestos (chrysotile), clay, mica and pyrrhotite are presented. (41 refs.)

69335 Some scientific objectives of a satellite-borne lightning mapper. M.H.Davis (Univ. Space Res. Assoc., Boulder, CO, USA), M.Brook, H.Christian, B.G.Heikes, R.E.Orville, C.G.Park, R.G.Roble, B.Vonnegut.
Bull. Am. Meteorol. Soc. (USA), vol.64, no.2, p.114-19 (Feb. 1983).
The Lightning Mapper Sensor is proposed as an instrument for use on a geosynchronous satellite in the late 1980s to monitor lightning activity continuously over broad areas of the Earth. The system was suggested in response to a variety of needs and the resulting data will provide important research information for such fields of geoscience as magnetospheric and ionospheric physics, atmospheric electricity, atmospheric chemistry, and storm physics. The research applications of Lightning Mapper Sensor data and related research programs are explored and sensor requirements are discussed. (12 refs.)

69336 Using midday surface temperature to estimate daily evaporation from satellite thermal IR data. B.Seguin (Station de Bioclimatologie, INRA, Montfavet, France), B.Itier.
Int. J. Remote Sens. (GB), vol.4, no.2, p.371-83 (April-June 1983).
The practical experience obtained by participation in the European project TELLUS (a part of the HCMM programme) led the authors to state that the thermal inertia concept and sophisticated models are useful for understanding basic processes and for performing informative simulations, but cannot be used for a real estimation of evaporation. On the other hand, a simplified procedure like that proposed by Jackson et al. (1977) appears feasible, but its theoretical basis and its field of application are subject to discussion. Two main questions arise, namely, the conditions underlying the use of one instantaneous measurement to estimate daily integrated values, and the significance of the adjustment parameter B in the simplified relationship $ET_d=Rn_d-B(Ts-Ta)_i$ which relates the daily evaporation to daily net radiation by means of one measurement of the surface and air temperature at a given time of day. These questions are discussed with reference to results of recent experiments. (24 refs.)

69337 Measurement of wind across a microwave line-of-sight propagation path. G.D'Auria, D.Solimini (Istituto di Elettronica, Univ. di Roma, Rome, Italy).
Int. J. Remote Sens. (GB), vol.4, no.2, p.385-98 (April-June 1983).
Methods of measuring wind across a microwave propagation path are examined and specific problems involved are discussed. Both the initial slope and the time-delay method are considered and the use of a filter in the time domain for changing the shape of the weighting functions is examined. An experiment that has been carried out at X-band along a 37 km propagation path over hilly terrain is described. In this experiment emphasis has been given to straightforward procedures for inferring the wind across the path by making use of simple wind models valid for some kind of air circulation. A comparison of the results with data obtained from conventional wind measurements is reported. (13 refs.)

69338 An approximate procedure to isolate single scattering contribution to lidar returns from fogs. P.Bruscaglioni, G.Zaccanti (Istituto di Fisica Superiore, Univ. di Firenze, Firenze, Italy), L.Pantani, L.Stefanutti.
Int. J. Remote Sens. (GB), vol.4, no.2, p.399-417 (April-June 1983).
Lidar signatures from fogs can be affected by a substantial contribution from multiple scattering. This latter is strongly dependent on the aperture α of the receiver's field of view. Since lidar IROE IV allows the use of different values of α, an analysis is made of an approximate procedure to process the data in order to extract the single scattering contribution to the received power. Some experimental results are presented. (7 refs.)

69339 The design of optimum remote-sensing instruments. G.F.Peckham (Heriot-Watt Univ., Edinburgh, Scotland), D.A.Flower.
Int. J. Remote Sens. (GB), vol.4, no.2, p.457-63 (April-June 1983).
Remote-sensing instruments allow values for certain properties of a target to be retrieved from measurements of radiation emitted, reflected or transmitted by the target. The retrieval accuracy is affected by random variations in the many target properties which affect the measurements. The authors describe how statistical properties of the target and theoretical models of its electromagnetic behaviour can be used to choose values for the instrument parameters which maximise the retrieval accuracy. The technique is applicable to a wide range of remote-sensing instruments. (14 refs.)

69340 Optimising a remote sensing instrument to measure atmospheric surface pressure. G.E.Peckham, C.Gatley (Heriot-Watt Univ., Edinburgh, Scotland), D.A.Flower.
Int. J. Remote Sens. (GB), vol.4, no.2, p.465-78 (April-June 1983).
Atmospheric surface pressure can be remotely sensed from a satellite by an active instrument which measures return echoes from the ocean at frequencies near the 60 GHz oxygen absorption band. The authors optimise the instrument by selecting its frequencies of operation, transmitter powers and antenna size through a new procedure based on numerical simulation which maximises the retrieval accuracy. The predicted standard deviation error in the retrieved surface pressure is 1 mb. In addition the measurements can be used to retrieve water vapour, cloud liquid water and sea state, which is related to wind speed. (26 refs.)

69341 Seismic contact transducer. A.V.Rykov.
Seism. Instrum. (USA), p.1-4. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.3-6 (1980).
Describes a seismic parametric displacement sensor which measures the electrical conductivity of contacts of two conductors that changes jumpwise 0 to ∞. One contact is attached to the pendulum and the other, to the seismometer. Displacement and velocity feedback circuits are used to get the pendulum into high frequency, low-amplitude oscillations that cause closing and opening of the contacts, resulting in pulse duration modulation of the pendulum displacements. The acceleration sensitivity of the transducer model without electronic amplification varies within the range 0.1-10 V/gal. (4 refs.)

69342 STKS symmetric three-component electrodynamic seismometer. G.L.Shnirman.
Seism. Instrum. (USA), p.5-10. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.7-13 (1980).
Describes the STKS symmetric, three-component, electrodynamic field seismometer designed and developed at the Institute of Physics of the Earth of the Soviet Academy of Sciences. The seismometer is intended for long-duration operation under field conditions. (5 refs.)

69343 Multichannel seismographs with galvanometric recording. A.G.Mysh.
Seism. Instrum. (USA), p.11-17. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.13-20 (1980).
Transfer functions and the frequency response of seismometers with n degrees of freedom, equipped with a single transducer but having different configurations are derived and analyzed. (8 refs.)

69344 N-052 engineering-seismic system. Yu.M.Kuchinskii, Yu.M.Sil'yanov, A.A.Fridman.
Seism. Instrum. (USA), p.18-28. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.20-34 (1980).
A 14-channel FM magnetic recording system equipped with a magnetic drum delay memory is described. The system is intended for registration of local and near earthquakes and can be used under stationary and field conditions. (no refs.)

69345 Magnetic drum recorder of seismic blast waves. Yu.B.Dvoeglazov, V.M.Sergeev.
Seism. Instrum. (USA), p.37-43. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.42-9 (1980).
Describes a magnetic drum recorder of seismic blast waves. The principal design parameters of the magnetic drum and the aerodynamic magnetic head mount are calculated. Requirements imposed on the electronics of the recorder are formulated. (2 refs.)

69346 Digital-to-analog converter unit. G.S.Grebenchuk.
Seism. Instrum. (USA), p.49-50. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.55-6 (1980).
Describes a digital-to-analog (frequency) converter developed in conjunction with other equipment for registration of parallel-coded signals on a single track of a magnetic tape. This is achieved by means of narrow-band frequency manipulation (modulation) and recording in frequency separated, record-playback channels. Seismic applications are considered. (2 refs.)

69347 Dynamic memory systems of geophysical equipment. G.S.Grebenchuk.
Seism. Instrum. (USA), p.51-3. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.57-9 (1980).
Deals with problems encountered in using operational memory devices in geophysical recording equipment. Various types of signal storage and delay lines are considered. The design of a dynamic memory system consisting of a shift register is described and its characteristics are given. (4 refs.)

69348 A device for converting analog records of autonomous ocean-bottom seismograph systems into digital form and recording on a digital tape recorder in ES computer format. A.M.Bodyagin, V.P.Karman, B.Ya.Karp, V.E.Smolin, A.V.Sudakov, R.P.Chaptsov.
Seism. Instrum. (USA), p.54-6. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.60-3 (1980).
A device is described for converting analog signals into digital ES computer format adapted to peculiarities of analog data recording of autonomous ocean-bottom seismograph systems. The device records signals from three signal channels of ocean-botton seismographs at two gain levels with a dynamic range of 60 dB. Digitizing rate is determined by the repetition rate of synchronous pulses recorded on the tape recorder of the ocean-bottom seismograph. This makes it possible to decrease the error associated with tape speed nonuniformities during recording and playback. (no refs.)

69349 Use of materials based on antimony sulfoiodide in piezoelectric seismometers. G.K.Arakelyan, V.A.Lyakhovitskaya, V.D.Spitsina, V.M.Fremd.
Seism. Instrum. (USA), p.57-60. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.63-7 (1980).
The results of experimental measurements of the principal electrophysical parameters of crystalline piezoelectric materials based on SbSI are considered. High values of bulk piezoelectric modulus and fairly low values of transverse piezoelectric moduli make it possible to develop small piezoelectric seismometers made of these materials with almost zero transverse sensitivity. Several characteristics of materials based on SbSI, promising for use in piezoelectric seismometers are discussed. (3 refs.)

69350 Methods and certain results of tests of SSRZ-M accelerographs. D.P.Kirnos, V.I.Davydov, M.V.Zabelin, A.I.Levin, A.E.Manokhin, S.M.Potapov.
Seism. Instrum. (USA), p.61-71. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.67-78 (1980).
Describes methods of determining the principal operating parameters of the SSRZ-M accelographs (sensitivity, natural frequency, damping constant, trigger level of the starter, timing marks) and its characteristics (linearity and transverse sensitivity). The principal results of tests of the accelerograph are given. (3 refs.)

69351 A technique of increasing reliability of transient (pulse) calibration of complex seismographs. Z.I.Aranovich, A.Ya.Melamud, E.S.Gomzyakova, A.Plesinger, I.Khoralek.
Seism. Instrum. (USA), p.93-6. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.100-3 (1980).
A technique of decreasing the number of parameters determined by the least squares method is utilized in order to increase the reliability of transient calibration of complex seismographs. The parameters obtained in this manner are used to calculate the sensitivity curve throughout the whole required range of periods with an accuracy sufficient for practical applications. (3 refs.)

69352 Choice of parameters of seismographs for registration of distant earthquakes. Z.I.Aranovich, N.L.Trapeznikov.
Seism. Instrum. (USA), p.102-6. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.108-12 (1980).
The dependence of amplitudes and periods of seismic phases on the magnitude and the epicentral distance is established. This makes it easy to select the required parameters of seismographs (sensitivity, dynamic range, magnification curve). Several variants of sets of seismographs that will record teleseismic earthquakes of magnitude $M \geq 4$ are considered. (9 refs.)

69353 Simple high-sensitivity short-period electronic velocity seismograph. N.L.Trapeznikov.
Seism. Instrum. (USA), p.107-8. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.114-15 (1980).
An electronic seismograph is described that is constructed using mass produced components. The seismograph can be used with any type of recording system, including digital recorders. Parameters are given and the components are described. (2 refs.)

69354 A floating point formatter for digitally recording seismic systems. S.A.Negrebetskii, I.M.Turetskii.
Seism. Instrum. (USA), p.115-18. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.122-6 (1980).
A universal floating point formatter for seismic data acquisition systems has been developed. The device converts input signals with amplitudes ranging over 12 dB into an analog mantissa of a number for input into a 10-bit analog-to-digital converter and into a two bit exponent. Only integrated circuits are used in the formatter. The design of the formatter makes possible its wide use in various geophysical recording systems. (6 refs.)

69355 Digital magnetic narrow-band frequency-manipulated and summed (NFMAS) recording of strong earthquakes. G.S.Grebenchuk.
Seism. Instrum. (USA), p.119-28. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.126-37 (1980).
Describes a method of digital magnetic recording of strong earthquakes by means of narrow-band frequency manipulation and summation of multi-byte information. This method makes it possible to use one track of a magnetic tape for frequency-separated digital record-playback channels. Certain theoretical problems of choosing parameters of digital recording are considered and a strong motion seismograph designed on this principle is described. A dynamic type, digital delay line that makes it possible to utilize standby operation modes for registration of strong earthquakes is also described. (7 refs.)

69356 Equipment for regional seismic investigations. Yu.V.Brulev, G.G.Krylov, I.L.Nersesov, V.I.Raizman, G.A.Sychev, V.F.Totmenin.
Seism. Instrum. (USA), p.129-41. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.138-53 (1980).
Describes equipment for regional seismic investigations consisting of a three-component short-period seismometer; a field magnetic recording system and a radiotelemetry system for seismic data transmission. (2 refs.)

69357 Two operating modes of a piezoelectric accelerometer. G.K.Arakelyan, B.G.Uspenskii.
Seism. Instrum. (USA), p.142-4. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.154-6 (1980).
A piezoelectric accelerometer operating in a no-load mode is considered. A formula is derived for the sensitivity of a piezoelectric accelerometer operating in a short-circuit integrating mode. Recommendations are given on the choice of the operating mode of a piezoelectric accelerometer in an industrial seismic warning system. (6 refs.)

69358 Electronic time mark generator for light-beam oscillographs [seismic applications]. I.M.Rozenberg.
Seism. Instrum. (USA), p.145-6. Translation of: *Seism. Prib. Instrum. Sredstva Seism. Nabl. (USSR)*, vol.13, p.156-7 (1980).
An electronic, 10 Hz time mark generator constructed using integrated circuits is described. The AC power grid is used as the source of the reference frequency. (2 refs.)

69359 An accuracy goal for a comprehensive satellite wind measuring system. N.A.Phillips (Nat. Meteorological Center, NOAA, Washington, DC, USA).
Mon. Weather Rev. (USA), vol.111, no.1, p.237-9 (Jan. 1983).
Variational analysis with a geostrophic constraint is used to estimate a critical accuracy for a satellite lidar wind measuring system. This accuracy is such that the combination of satellite winds with satellite temperatures can produce analyses with an accuracy equal to that obtained from a rawinsonde network. An important assumption allowing this estimate to be made is that the satellite wind and temperature measurements are made with a spatial density equal to that of the rawinsonde network. (8 refs.)

69360 Laboratory calibration of the Photon-1 spectrometer for measuring the ultraviolet emission of the atmosphere on the IKB-1300 satellite. M.Yu.Kozlovskii, V.G.Kurt, M.D.Nusinov, T.V.Perevodchikova, Yu.S.Pogodin, L.P.Smirnova, M.Gogoshev, S.Sargoichev.
Cosmic Res. (USA), vol.20, no.4, p.451-60 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.620-30 (July-Aug. 1982). [received: April 1983]
The method of calibrating the ultraviolet spectrometer installed on board the Interkosmos-Bulgaria 1300 satellite for measuring the resonance emission of the upper atmosphere of the Earth between 1150 and 2500 Å is presented. A description of the high-vacuum measurement apparatus is given. The results of a calibration using a PMT calibrated agaist a synchrotron accumulator are presented. (24 refs.)

69361 Seismic transducers: load amplifiers and signal conditioners. IV. C.Parmigiani.
Elettron. Oggi (Italy), no.1, p.159-70 (Jan. 1983). In Italian.
For pt.III see ibid., no.12, p.239 (1982). The first section deals with load amplifiers. It includes sample schematics and some mathematical relationships and performance curves. There is a photograph of a low noise level load amplifier. The triboelectric effect is described, with the help of a diagram. The effect of a shunt resistance in the input of a load amplifier is described, with the help of further schematics. Some numerical examples are given and worked out and some further mathematical relationships are given. A series of graphs is given. These show increase of noise with frequency, the 'slow rate' effect, a curve for an integrator circuit and a nomogram for calculating 'slow rate'. A section describes the methods of preparing signals for piezoresistive accelerometers, with two simple schematics. The preparation of the accelerometer is also described. (2 refs.) *G.V.D.*

69362 Resistivity/depth mapping with airborne electromagnetic survey data. K.-P.Sengpiel (Bundesanstalt fur Geowissenschaften und Rohstoffe, Hannover, Germany).
Geophysics (USA), vol.48, no.2, p.181-96 (Feb. 1983).
Using the homogeneous half-space as a universal interpretation model, all of the secondary field data obtained with a single-frequency airborne electromagnetic (EM) system that satisfies the superposed dipole condition can be converted to the model parameters ρ_a (apparent resistivity) and d_a (apparent depth). These parameters are investigated for their behavior above various conductivity models and at various flight altitudes. Moreover, a depth value has a meaning only within the lateral limits of a target conductor. A method is described to locate these lateral limits and to select acceptable depth and resistivity values. The results of the resistivity/depth mapping model are presented in the form of two contour maps. (2 refs.)

69363 Automated identification of rock boundaries: an application of the Walsh transform to geophysical well-log analysis. E.N.Lanning, D.M.Johnson (Univ. of Washington, Seattle, WA, USA).
Geophysics (USA), vol.48, no.2, p.197-205 (Feb. 1983).
A system of orthogonal functions, known as Walsh functions, which assume only the values $+1$ and -1, are presented as a tool appropriate for the analysis of well-log data. Many of the characteristics of these rectangular waveforms, such as discrete transitions in signal level, make them ideal for processing borehole data. Using the generalized Fourier transform, the basic equations for the Walsh transform and Walsh power spectrum are developed showing how the energy in a given signal is distributed among these rectangular wave components. As a first application of the Walsh transform to logging data, a method of computer-aided rock boundary identification is developed and demonstrated on a set of well logs from a continental basalt sequence. (6 refs.)

69364 Airborne gravity is here!. S.Hammer (Dept. of Geology & Geophys., Univ. of Wisconsin-Madison, Madison, WI, USA).
Geophysics (USA), vol.48, no.2, p.213-23 (Feb. 1983).
The achievement of practical and useful airborne gravity exploration for petroleum is a major culmination of more than twenty years of research and development. Commercial surveys have now been conducted for three years. The precision and anomaly resolution attainable are twice as good as that of current shipborne gravity data. The author presents data to demonstrate the precision of airborne gravity and discusses its usefulness. (25 refs.)

69365 Deconvolution of seismograms by the autoregressive method. G.J.Nair (Neutron Phys. Div., Bhabha Atomic Res. Centre, Bombay, India).
Geophysics (USA), vol.48, no.2, p.229-33 (Feb. 1983).
A method of deconvolution of single-channel seismic data based on an autoregressive mode of the time series is discussed. With it one can estimate the primary pulses and the deconvolution function simultaneously in an objective manner. Examples are provided to substantiate the applicability of the method using synthetic data simulating single and multiple explosions. The method is also applied to actual data for a presumed underground explosion from Eastern Kazakh. (10 refs.)

69366 Werner deconvolution of profile potential field data. K.T.Kilty.
Geophysics (USA), vol.48, no.2, p.234-7 (Feb. 1983).
Werner (1953), in analyzing the magnetic fields of dipping, magnetized dikes, proposed a method of separating the field contributed by the particular dike under study from the interference of neighbouring dikes. The author discusses some limitations of the Werner method of deconvolution and also points out some possible extensions of the method to the general interpretation of potential field data. (8 refs.)

69367 Computer processing of vertical seismic profile data. M.W.Lee (US Geological Survey, Denver Federal Center, Denver, CO, USA), A.H.Balch.
Geophysics (USA), vol.48, no.3, p.272-87 (March 1983).
Vertical seismic profiles (VSP) are a powerful tool in a variety of seismic exploration situations. Only after extensive computer processing of the raw field data, however, can the full value of this tool be realized. With the help of processing, relations between important rock parameters and acoustic properties can sometimes be established and highly reliable ties from well logs to surface seismic profiles can usually be obtained. The basic theory of the processing techniques is well known. However, the techniques used in processing standard surface seismic profiles usually must be modified to adapt them to the unique conditions associated with VSPs. Processing procedures, and their relevance to the interpretation of VSP and surface seismic profile data, are described. (8 refs.)

69368 Synthetic body wave seismograms for laterally varying layered structures by the Gaussian beam method. V.Cerveny (Inst. of Geophys., Charles Univ., Praha, Czechoslovakia).
Geophys. J. R. Astron. Soc. (GB), vol.73, no.2, p.389-426 (May 1983).
Several approaches to computing body wave seismograms in 2-D and 3-D laterally inhomogeneous layered structures are suggested. They are based on the Gaussian beam method, which has been recently applied to the evaluation of time-harmonic high-frequency wavefields in inhomogeneous media. Three variants are discussed in some detail: the spectral method, the convolutory method and the wave-packet method. The most promising seems to be the wave-packet approach. In this approach, the wavefield, generated by a source, is expanded into a system of wave packets, which propagate along rays from the source in all directions. The resulting seismogram at any point of the medium is then obtained as a superposition of those packets which propagate close to the point. Numerical examples of synthetic seismograms computed by the wave-packet approach are presented. (91 refs.)

69369 Analysis of palaeomagnetic time series—techniques and applications. C.E.Barton (Graduate School of Oceanography, Univ. of Rhode Island, Kingston, RI, USA).
Geophys. Surv. (Netherlands), vol.5, no.4, p.335-68 (Feb. 1983).
This review is intended to provide an introduction for the nonspecialist to concepts and techniques which are useful for analysing palaeomagnetic time series. Emphasis is placed on analysis in the frequency domain, particularly the periodogram and maximum entropy methods. The review consists of two parts dealing with techniques and applications respectively. (107 refs.)

69370 Review of archaeointensity methods. R.Thomas (Dept. of Geophys., Univ. of Edinburgh, Edinburgh, Scotland).
Geophys. Surv. (Netherlands), vol.5, no.4, p.381-93 (Feb. 1983).
Most of the traditional methods of determining the intensity of the ancient geomagnetic field from archaeological materials utilized thermal demagnetization of the natural remanent magnetization (NRM) and of the laboratory induced thermoremanent magnetization (TRM). When applied rigorously these methods are foolproof. They are, however, very time consuming and the number of samples with which they can be used is limited. Attempts to speed up these traditional methods have generally led to the use of subjective criteria in assessing the reliability of the results and archaeomagnetic research has recently been concentrated on extending the range of samples to which the method can be applied. Through the use of alternating field, rather than thermal, demagnetization of NRM and TRM it has become possible to apply corrections for alteration occurring during laboratory firing of the archaeological samples and develop objective criteria of reliability. Recent research has shown that it may be possible to determine archaeointensities by the laboratory redeposition of lake sediments. (28 refs.)

69371 The chemistry of geothermal waters in Iceland. III. Chemical geothermometry in geothermal investigations. S.Arnorsson, E.Gunnlaugsson (Sci. Inst., Univ. of Iceland, Reykjavik, Iceland), H.Svavarsson.
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.567-7 (March 1983).
For pt.II see ibid., vol.47, no.3, p.547-66 (1983). New data from geothermal wells in Iceland have permitted empirical calibration of the chalcedony and Na/K geothermometers in the range of 25-180°C and 25-250°C respectively. The temperature functions are: $t°C=1112\ (4.91-\log SiO_2)^{-1}-273.15$ and $t°C=933(0.993+\log Na/K)^{-1}-273.15$. Concentrations are expressed in ppm. These temperature functions correspond well with the chalcedony solubility data of Fournier (1973) and the thermodynamic data for low-albite/microcline/solution equilibria of Helgeson (1969). A new CO_2 geothermometer is proposed which is considered to be useful in estimating underground temperatures in fumarolic geothermal fields. (36 refs.)

69372 Precision measurements of rare radioisotopes with a tandem Van de Graaff accelerator. M.Suter, R.Balzer, G.Bonani, M.Nessi, Ch.Stoller, W.Wolfli (Lab. fur Kernphys., ETH, Zurich, Switzerland), M.Andree, J.Beer, H.Oeschger.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1528-31 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The existing accelerator facility has been improved for accurate measurements of rare radioisotopes. So far the system has been applied for ^{14}C dating and studies of ^{10}Be in various geophysical samples. The properties of the accelerator based mass spectrometer have been studied extensively. (8 refs.)

69373 Small accelerators for borehole application. G.R.Morris, C.H.Bush, J.W.Reichardt (Kaman Instrumentation Corp., Colorado Springs, CO, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1648-51 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
After a general discussion on the utility of pulsed high energy neutrons in borehole applications, the authors summarize the operational and environmental characteristics of borehole configured neutron generators. They discuss design, operation and performance characteristics of a 1 11/16" outside diameter generator which has recently been developed for use in geologic well logging. (14 refs.)

69374 Carbon-Oxygen Log applications in complex reservoir evaluation by neutron interactions from (D,T) accelerators. M.J.Lochmann (GeoNuclear Consultants Inc., Abilene, TX, USA), L.O.Berg, R.C.Ivey.
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1652-6 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
Granite Wash reservoirs in Oklahoma, Texas, Colorado and New Mexico have proven to be effective commercial producers of hydrocarbons. Substantial drilling activity continues to penetrate this formation either as a primary or secondary objective. A new technique to provide additional lithologic data to engineers and geologists will yield significant benefits in the evaluation and treatment of these reservoirs. This information can be obtained by data available from spectrum analysis through the use of tools such as the Carbon/Oxygen Log, Spectralog and NGS. (7 refs.)

69375 Status of a pulsed-neutron logging probe using a high-purity germanium detector. D.H.Jensen, R.W.Barnard, H.M.Bivens, D.R.Humphreys, J.H.Weinlein, W.A.Stephenson (Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1657-63 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
In 1979 Sandia began the development of a logging tool to identify elements contained in minerals often associated with the deposition of uranium. This tool, a multi-element logging probe containing a high-purity germanium detector, may be used in two modes; passive—which detects the gamma rays emitted from natural radionuclides in a formation, and active—which uses a pulsed neutron generator to irradiate the rock formation surrounding a borehole and detects the gamma rays gnerated from interactions with nuclei in the formation. The authors briefly review the probe design and describe some of the operational experiences and analytical results of field logging work with the probe. (5 refs.)

69376 Experiences with a PFN uranium logging system. R.W.Barnard, W.A.Stephenson, J.H.Weinlein, D.H.Jensen, D.R.Humphreys (Special Applications Div., Sandia Nat. Labs., Albuquerque, NM, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1664-7 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
The Prompt Fission Neutron (PFN) uranium logging system has been used by Sandia National Laboratories for field operations for about six years; during that time, the system has been used at several exploration sites from southern Texas to Wyoming. Some of the improvements, recent changes to the system, and new applications are discussed. (8 refs.)

69377 Restitution of atmospheric optical parameters profiles using laser sounding data. V.E.Zuev, S.I.Kavkyanov, G.M.Krekov.
Izv. Akad. Nauk SSSR Fiz. Atmos. & Okeana, vol.19, no.3, p.255-66 (March 1983). In Russian. English translation in: *Izv. Acad. Sci. USSR Atmos. & Oceanic Phys. (USA)*
Noiseproof and accuracy of restitution of atmospheric optical parameters are investigated using the data of single-frequency sounding. A statistical model of lidar measurements interpretation is suggested that enables one to use a priori information on noises and solutions for constructing optimal noiseproof interpretation algorithms. (16 refs.)

69378 Relations between the acoustic response (5 kHz) and the lithologic character of sea floor. M.Frappa, M.Duprat (Lab. d'Etudes et de Recherches de Geophys. Appliquee, Univ. de Bordeaux, Talence, France).
Mar. Geophys. Res. (Netherlands), vol.5, no.4, p.405-19 (1983). In French.
Studies the ability of seismic methods to probe the structure of seafloor sediments. Seismic recordings are compared to bucket dredged and core samples from a 15 km^2 survey area. (6 refs.)

69379 Isolated sensor ocean bottom seismometer. D.A.Byrne, G.H.Sutton, J.G.Blackinton, F.K.Duennebier (Hawaii Inst. of Geophys., Univ. of Hawaii, Honolulu, HI, USA).
Mar. Geophys. Res. (Netherlands), vol.5, no.4, p.437-49 (1983).
In most of the Ocean Bottom Seismometers (OBS) used today, the sensors, electronics, recorders, flotation, and ballast are contained in one rigid package. Usually this configuration requires a large mass, a large vertical cross section in the water, and relatively small bearing surface area in contact with the bottom, resulting in poor seismic characteristics and increased noise sensitivity. An OBS recently developed at the Hawaii Institute of Geophysics (HIG) minimizes these problems by physically separating the sensor from the main OBS package. Direct comparison between signals recorded by a standard HIG configuration Pop-up Ocean Bottom Seismometer (POBS) and signals from the new Isolated Sensor Ocean Bottom Seismometer (ISOBS), deployed near each other in deep water, clearly demonstrates the advantages of the isolated sensor configuration. (11 refs.)

69380 Survey of high resistivity basement by common measurement of electric and magnetic fields of quasi-stationary point sources. L.Szarka (MTA Geodeziai es Geofizikai Kutato Intezete, Sopron, Hungary).
Magy. Geofiz. (Hungary), vol.24, no.1, p.1-10 (1983). In Hungarian.
One of the basic problems of the geoelectric exploration is to determine the thickness of the high conductivity sediments above a high resistivity basement. The author determines the horizontal electric conductance on the basis of the impedance calculated from the electric and magnetic fields of distant quasi-stationary point sources. Applying the proposed method, the horizontal conductance of the sediments can be determined from artificial noise coming from sources of unknown position and intensity. The results of analogue modeling and field examples prove the correctness of this theory. (7 refs.)

69381 Dynamic sampling. A numerical solution and employment of Fourier transformation for describing the IP effect by system characteristic functions. E.Turai (Nehezipari Muszaki Egyetem, Geofizikai Tanszek, Budapest, Hungary).
Magy. Geofiz. (Hungary), vol.24, no.1, p.11-19 (1983). In Hungarian.
A numerical method for Fourier transformation of sampled signals is discussed. Advantages over the generally used discrete Fourier transformation

and fast Fourier transformation are considered. The Fourier transformation method discussed is suitable amongst others for the transformation of induced polarisation (IP) curves and for describing the IP-effect by system characteristic curvers. (6 refs.)

69382 The maximum entropy method (MEM), determination of time series spectra by MEM. M.Varga (MTA Geodeziai es Geofizikai Kutato Intezete, Sopron, Hungary).
Magy. Geofiz. (Hungary), vol.24, no.1, p.20-2 (1983). In Hungarian.
Presents an extension to the paper on the 'Use of maximum entropy method in geomagnetic time series' by Szendroi, (1983) Varga, Vero (1983) and gives a theoretical summary of the subject. The author describes the program package in a digested form. (4 refs.)

69383 Use of maximum entropy method in geomagnetic time series. J.Szendroi, M.Varga, J.Vero (MTA Geodeziai es Geofizikai Kutato Intezete, Sopron, Hungary).
Magy. Geofiz. (Hungary), vol.24, no.1, p.23-32 (1983). In Hungarian.
In the reduction of geomagnetic observatory or magnetotelluric field data determination of the data spectrum is a frequent process. In both cases there is a problem in computing a good quality spectrum from relatively short recordings (that contain few complete waves). To solve this problem estimation of maximum entropy spectrum was developed. The authors describe the effectivity of MEM spectrum estimation. The use of MEM is favourable if one wants to show the presence of several periods in a given time. The method does not give precise information about the power ratio of certain components. (1 ref.)

69384 Lidar system for visibility monitoring. F.Castagnoli, M.Morandi, I.Pippi, B.Radicati (CNR-IROE, Firenze, Italy).
Opt. & Quantum Electron. (GB), vol.15, no.3, p.261-8 (May 1983).
Describes a Lidar (light detection and ranging) system. It allows high-speed data acquisition of Lidar signals and meteorological parameters by means of standard instrumentation. The Lidar, controlled by a computer, utilized two laser sources (Nd: Yag and ruby), a modified Ricthey-Chretien telescope and signal detection, storage and real-time monitoring equipment. The whole system was installed in a container for field experiments. (13 refs.)

69385 A method of construction of a resonator radio refractometer. B.A.Levin, V.A.Pavlyushnev, N.K.Proschechkin.
Radio Eng. & Electron. Phys. (USA), vol.27, no.6, p.68-71 (June 1982). Translation of: *Radiotekh. & Elektron. (USSR)*, vol.27, no.6, p.1128-31 (June 1982). [received: May 1983]
A new method is proposed for measurement of the index of refraction of the atmosphere by the resonator method which uses a discrete scanning of frequency of the exciting signal. The error resulting from the suggested method of measuring is analyzed and the instrument error of the realized radio refractometer is estimated. One of the technical realizations of the instrument is briefly described, its block diagram and external photographs are given. The RMS error of measurement of the index of refraction by a radio refractometer with discrete frequency scanning was not more than ±0.1 *N*-units. (7 refs.)

69386 Density distribution of the flux of delayed fission neutrons in water. E.G.Vertman.
Sov. At. Energy (USA), vol.53, no.2, p.574-5 (Aug. 1982). Translation of: *At. Energ. (USSR)*, vol.53, no.2, p.116-17 (Aug. 1982). [received: April 1983]
Activation analysis of geological material for uranium and thorium, based on the method of delayed neutrons, imposes especially stringent requirements on the recording units. In order to improve the sensitivity of the method, it is necessary to maximize the neutron recording efficiency and minimize the background. This can be achieved by a suitable choice of detectors and by using the optimum measurement geometry. The author investigates the density distribution of the flux of delayed fission neutrons from a point source in water in order to determine the optimum recording geometry. (3 refs.)

69387 Grid generation for environmental flows. W.C.Thacker (Atlantic Oceanographic & Meteorological Labs., NOAA, Miami, FL, USA).
10th IMACS World Congress on System Simulation and Scientific Computation, Montreal, Canada, 8-13 Aug. 1982 (New Brunswick, NJ, USA: IMACS 1982), p.266-9, vol.2
For numerical models based on the shallow water wave equations, computational grids should be configured so that the distance separating neighboring points is proportional to the local depth. A fully automatic scheme for generating such grids for natural basins with varying bathymetry is presented. (27 refs.)

69388 Estimation of the atmospheric path radiance from multispectral infrared images. T.Yokota (Nat. Inst. for Environmental Studies, Ibaraki, Japan), H.Hanaizumi, M.Inamura, S.Fujimura, H.Toyota.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.319-28 vol.1
Described is a method for extracting the spatial pattern of the atmospheric path radiation, substantially due to water vapor in the IR region from remotely sensed data. The authors use three IR bands 4.3-5.5 μm, 4.5-4.9 μm, and 10.5-12.5 μm. The atmosphere gives different affects on the data in the bands. By computer simulation and experiments using actual data it is confirmed that the ratio (W(10.5-12.5)-W(4.5-4.9))/(W(10.5-12.5)-W(4.3-5.5)) calculated from the data obtained in the three bands is an increasing function of path radiance. Sufficient conditions for band selection are also discussed. (4 refs.)

69389 Main advances and needs on the study of geothermal resources in Chile by using remote sensing techniques. M.F.Araya (Univ. de Chile, Santiago, Chile), R.L.Piraces, M.P.Pardo.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.577-86 vol.1
Successful preliminary results have been obtained in several pilot experiments related to the study of geothermal resources in the Los Andes Range, Chile by using remote sensing techniques. These results are related to prospecting and exploration stages of a geothermal field. Multispectral and multitemporal satellite and aereal photographs and images have been used for these purposes. Based on the results, a general global program is intended to study geothermal resources along the whole country. This methodology is also applied to other countries along the Los Andes Range. The main aspects of the performed experiments and the future activities related with this global program are included. (4 refs.)

69390 Microwave remote sensing of sea ice. R.K.Hawkins, A.L.Gray, C.E.Livingstone, L.D.Arsenault (Canada Centre for Remote Sensing, Ottawa, Ontario, Canada).
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.789-99 vol.1
Reviews a series of airborne microwave experiments on sea ice conducted by the Canada Centre for Remote Sensing during the period 1979 to 1982. Principal sensors used include a Ku-band, dual-polarized scatterometer, a K-band radiometer and the SAR-580, a synthetic aperture radar operating at X-, C-, and L-bands with dual polarization. The potential of simultaneous active and passive sensors for the detection and identification of various sea-ice classes is examined with profiling sensor data and the implication for operational reconnaissance is supported by radar imagery examples. The influence of radar parameters, including frequency, polarization, incidence angle, resolution, and sensitivity, on the interpretability of microwave imagery of sea ice is discussed for airborne and satellite systems. (27 refs.)

69391 Microwave signatures and mapping of snow. E.Schanda, C.Matzler, K.Kuenzi, S.Patil (Inst. of Appl. Phys., Univ. of Berne, Berne, Switzerland), H.Rott.
Actes du Symposium International de la Commision VII de la Societe Internationale de Photogrammetrie et Teledetection (International Society of Photogrammetry and Remote Sensing Commission VII International Symposium), Toulouse, France, 13-17 Sept. 1982 (Toulouse, France: Groupement pour le Developpement de la Teledetection Aerospatiale 1982), p.801-9 vol.1
Ground-based and satellite-borne microwave sensors have been used to investigate and utilize the microwave signatures of snow. Typical signatures for dry and wet snow can be used to identify and quantify this type of snow. Also some unusual behavior of the snow cover (e.g. melt-freeze cycles, precipitation) can be identified by remote microwave probing. The feasibility of mapping the global snow cover (extent, water equivalent, onset of snow melt) has been demonstrated with the use of Nimbus-7 SMMR data. (10 refs.)

69392 Ring core magnetometers at 200°C [oil well application]. M.R.Foster, R.E.Poole, J.A.Skinner (Plessey Electronic Systems Res. Ltd., Havant, England).
Colloquium on 'High Temperature Electronics', London, England, 23 March 1983 (London, England: IEE 1983), p.5/1-2
A requirement has arisen for the use of magnetometers as a 3-dimensional compass system to measure the Earth's field components in 3 axes at the bottom of an oil well, in order to establish the orientation of the tool. The depth of an oil well can be of the order of 4 miles or so, with a maximum ambient temperature at the bottom of about 100°C. Refrigeration methods are possible, but inconvenient, and it was requested that the possibility of using standard magnetometers be investigated. The authors provide a short summary of the methods of sharing magnetic fields, the considerations for high temperature operation and a qualitative account of the preliminary investigations made. (no refs.)

Regularizing the solution of the laser sounding equation of atmospheric aerosols by means of a stabilizing functional ....See Entry 66316

Rock density from borehole gravity surveys ....See Entry 69091

A least-squares approach to depth determination from gravity data ....See Entry 69092

Approximate method for direct interpretation of gravity anomalies caused by surface three-dimensional geologic structures ....See Entry 69093

DC telluric fields in three dimensions: a refined finite-difference simulation using local integral forms ....See Entry 69100

Cross-over analysis of marine magnetic anomalies ....See Entry 69107

Attenuation and anisotropy of channel waves in coal seams ....See Entry 69114

Applications of operator separation in reflection seismology ...See Entry 69118

Lattice filtering applications to deconvolution of seismic data ....See Entry 69119

Studies of the continental crust by near-vertical reflection methods: a review ....See Entry 69133

Earthquake dating: an application of carbon-14 atom counting ....See Entry 69135

Side-scan sonar mapping and computer-aided interpretation in the Santa Barbara Channel, California ....See Entry 69190

Microwave properties of saturated reservoirs ....See Entry 69194

A feldspar-liquid geothermometer ....See Entry 69201

The development and application of a geological simulation model ....See Entry 69204

New ice-forecasting procedures for the northwest Atlantic ......See Entry 69245

Quality of upwelling radiance retrieved from Coastal Zone Colour Scanner (CZCS) data for ocean colour determination ....See Entry 69249

A three dimensional hybrid finite element-finite difference scheme for groundwater simulation ....See Entry 69262

Statistical field significance and its determination by Monte Carlo techniques ....See Entry 69272

Extreme value analysis in meteorology ....See Entry 69300

Forecasting urban minimum temperatures from rural observations ....See Entry 69301

Dendroclimatological techniques in the study of climate history ....See Entry 69318

Investigation of remote sensing possibilities of the lower atmosphere in the microwave range and some aspects of statistical data use ....See Entry 69329

An operational program for monitoring surface temperatures of lakes and coastal-zone waters in Canada from polar-orbiting satellite infrared data ....See Entry 69332

Spatial and radiometric resolution of the Landsat-3 RBV system ....See Entry 69474

94.00 AERONOMY AND SPACE PHYSICS

94.10 PHYSICS OF THE NEUTRAL ATMOSPHERE

(for planets, see 96.30)

69393 The dynamic response of the high-latitude thermosphere and geostrophic adjustment. M.F.Larsen (School of Electrical Engng., Cornell Univ., Ithaca, NY, USA), I.S.Mikkelsen.
J. Geophys. Res. (USA), vol.88, no.A4, p.3158-68 (1 April 1983).
It was found that certain features of the response of the high-latitide thermosphere to inputs of energy and momentum can be explained qualitatively in terms of the theory of geostrophic adjustment. The adjustment process is critically dependent on the ratio of the scale size of the forcing to the Rossby radius of deformation, a natural parameter of the mean atmospheric state. When the ratio is small, large wind speeds are efficiently generated by a momentum source. When the ratio is large, changes in the mass field associated with a heat source are more effectively produced. The variation of the Rossby radius with height explains the qualitatively different responses of the high-latitude E and F regions during disturbed geomagnetic conditions as shown by both observations and numerical models. The E region is a more efficient generator of large winds, whereas the F region creates perturbations equally well in the mass field and the wind field. (33 refs.)

69394 Meridional neutral winds in the thermosphere at Arecibo: simultaneous incoherent scatter and airglow observations. R.G.Burnside (Dept. of Atmospheric & Oceanic Sci., Univ. of Michigan, Ann Arbor, MI, USA), R.A.Behnke, J.C.G.Walker.
J. Geophys. Res. (USA), vol.88, no.A4, p.3181-9 (1 April 1983).
Simultaneous measurements of ion and neutral wind velocities have been obtained at Arecibo, Puerto Rico, on several nights in both the summer and winter seasons. The diffusion velocity of O^+, calculated in an analysis by using the accepted value for the ambipolar; diffusion coefficient and the MSIS model atmosphere, is found to be in fairly close agreement with the observations. Incoherent scatter radar data have also been used to derive height profiles of the meridional neutral wind velocity. In the spring and summer months, the meridional wind is strongest near 2100 AST, with a southward velocity ranging from 50-100 m s^{-1}. At about 0100 AST the 'midnight descent' of the F layer occurs, in association with a slackening, or sometimes a reversal, of the meridional wind. (29 refs.)

69395 Thermospheric odd nitrogen. I. NO, $N(^4S)$, and $O(^3P)$ densities from rocket measurements of the NO δ and γ bands and the O_2 Hertzberg I bands. R.P.McCoy (Dept. of Astro-Geophys., Univ. of Colorado, Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3197-205 (1 April 1983).
Airglow emissions from the upper atmosphere were measured with instruments on a sounding rocket launched on November 7, 1979. The nitric oxide delta and gamma bands and the molecular oxygen Herzberg I bands were observed at evening twilight with a pair of ultraviolet spectrometers and a photometer. Nightglow emission of NO and O_2 were measured on the upleg. Twilight NO gamma band fluorescence and NO delta band chemiluminescence were measured on the downleg. The altitude profiles of the NO and O_2 nightglow emissions were inverted to yield the density of $O(^3P)$ between 90 and 120 km and the density of $N(^4S)$ between 100 and 200 km. These observations provide the first simultaneous measurements of the thermospheric densities of NO, $N(^4S)$, and $O(^3P)$. (51 refs.)

69396 Thermospheric odd nitrogen. II. Comparison of rocket observations with a diffusive transport chemical model. R.P.McCoy (Dept. of Astro-Geophys., Univ. of Colorado, Boulder, CO, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3206-10 (1 April 1983).
For pt.I see ibid., vol.88, no.A4, p.3197-205 (1983). A one-dimensional model of thermospheric odd nitrogen chemistry is used to simulate simultaneous rocket measurments of NO, $N(^4S)$ and $O(^3P)$ at twilight. Good agreement between the observations and the model is obtained for the $N(^4S)$ densities above 100 km and for the NO densities above 130 km. Differences between the $N(^4S)$ profiles from the upleg nightglow and downleg twilight airglow measurements are consistent with the diurnal variation of $N(^4S)$ predicted by the theory. The model shows that with high thermospheric temperatures the diurnal variation of NO decreases, while the $N(^4S)$ diurnal variation increases. This behaviour is attributed to the temperature sensitivity of the rate for the production of NO from $N(^4S)$ and O_2. The model is used to predict the solar cycle dependence of the NO chemiluminescence. (24 refs.)

69397 Concerning sources of $O(^1D)$ in aurora: electron impact and dissociative recombination. W.E.Sharp, D.Ortland, R.Cageao.
J. Geophys. Res. (USA), vol.88, no.A4, p.3229-32 (1 April 1983).
The electron impact and dissociative recombination source functions of $O(^1D)$ in the aurora are examined. The data from nine AE-D passes plus one rocket flight are examined at altitudes between 150 km and 335 km. It is found that in nighttime aurora 90% of the total source function is unidentified below 200 km. Electron impact (including thermal electrons) and dissociative recombination are probably adequate source functions above 250 km. (11 refs.)

69398 Solar variability and minor constituents in the lower thermosphere and in the mesosphere. G.Brasseur, P.de Baets, A.de Rudder (Inst. d'Aeronomie Spatiale, Brussels, Belgium).
Space Sci. Rev. (Netherlands), vol.34, no.4, p.377-85 (April 1982). [received: April 1983] (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The variation in the solar irradiance related for example to the 11-year cycle leads to changes in the photodissociation and photo-ionization of the upper and middle atmosphere. The strength of the particle precipitation is also modified. These phenomena are responsible for cyclic variations in the concentration of neutral constituents such as water vapor, nitric oxide, atomic oxygen and ozone, and of ionic compounds in the E- and D-region. Such effects have been simulated by means of a zonally-averaged two-dimensional model taking into account the latitudinal and seasonal dependences. As an example, the increase of thermospheric nitric oxide with solar activity, the corresponding enhancement of the downward flux of NO reaching the stratosphere during the winter and the impact of this effect on the photoionization will be considered. (22 refs.)

69399 Infrared emission of nitrogen oxide during the heating of the thermosphere. B.F.Gordiets, M.N.Markov.
Sov. Phys.-Lebedev Inst. Rep. (USA), no.8, p.42-6 (1982). Translation of: *Sb. Kratk. Soobshch. Fiz. AN SSSR Fiz. Inst. P.N. Lebedeva*, no.8, p.48-53 (1982).
It is shown theoretically that during magnetic storms which heat the gas to 2500-4000K, the NO concentration at altitudes 120-500 km reaches 1-10% of the total concentration, and the volume density of the infrared radiation is 10^{-3} erg.sec^{-1}.cm^{-2}. The calculations explain the results of cosmic experiments which measured the infrared radiation, and the anomalous concentrations of NO and N. (8 refs.)

Fifth International Symposium on Solar-Terrestrial Physics ....See Entry 64584

An estimate of the effect of the space-time coherence disturbances of the signal field on the effectiveness of optical communication lines in the atmosphere ....See Entry 69305

A method of construction of a resonator radio refractometer ..See Entry 69385

Measurements of metastable $N^+(^1D)$ 6584 Å emission in the twilight thermosphere ....See Entry 69400

A rocket observation of the 6300 Å/5200 Å intensity ratio in the dayside aurora: implications for the production of $O(^1D)$ via the reaction $N(^2D)+O_2 \rightarrow NO+O(^1D)$ ....See Entry 69401

The last 14 days of Skylab 1: orbit determination and analysis ....See Entry 69476

94.10Q Airglow and nightglow

69400 Measurements of metastable $N^+(^1D)$ 6584 Å emission in the twilight thermosphere. D.G.Torr, W.A.Abdou, M.R.Torr (Center for Atmospheric & Space Sci., Utah State Univ., Logan, UT, USA), R.G.Burnside, J.W.Meriwether,Jr..
J. Geophys. Res. (USA), vol.88, no.A4, p.3190-6 (1 April 1983).
Measurement of the 6584-Å emission that arises from the transition $N^+(^3P-{}^1D)$ were made at Sutherland, South Africa, in the summer of 1977. The twilight variations show a rapid decay at sunset from >10 R to 1 R followed by a persistent emission at ~1 R into the very later twilight. The authors identify the early twilight emission as being produced mainly by photodissociation ionization of N_2 and estimate a branching ratio $\beta \simeq 0.1$ for the production rate of N^+ in the (^1D) state. The authors conclude that electron quenching is the main loss process with an estimated value of $\sim 10^{-7}$ cm^3 s^{-1} for its rate coefficient k. (18 refs.)

Thermospheric odd nitrogen. I. NO, $N(^4S)$, and $O(^3P)$ densities from rocket measurements of the NO δ and γ bands and the O_2 Hertzberg I bands ....See Entry 69395

Conjugate studies of an isolated equatorial irregularity region ....See Entry 69409

94.10S Aurora

69401 A rocket observation of the 6300 Å/5200 Å intensity ratio in the dayside aurora: implications for the production of $O(^1D)$ via the reaction $N(^2D)+O_2 \rightarrow NO+O(^1D)$. R.Link (Centre for Res. in Experimental Space Sci., York Univ., Downsview, Ontario, Canada).
Geophys. Res. Lett. (USA), vol.10, no.3, p.225-8 (March 1983).
An analysis of rocket AMF-VB-41 measurements of the spatial variation of the I6300/I5200 intensity ratio in the dayside cleft and polar cap ionosphere is reported. The measured variation of the I6300/I5200 ratio is not consistent with significant production of 6300 Å emission via the reaction $N(^2D)+O_2 \rightarrow NO+O(^1D)$. An upper limit to the $O(^1D)$ yield of 0.1 is obtained for this mechanism. (12 refs.)

69402 N I [3466 Å] AND N I [5200 Å] emissions from various nighttime and daytime auroras. G.G.Sivjee, R.A.Marshall (Geophys. Inst., Univ. of Alaska, Fairbanks, AL, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3153-7 (1 April 1983).
N I [$2p^3$ $2P \rightarrow {}^4S$, 3466 Å] and N I [$2P^3$, $^2D \rightarrow {}^4S$, ~5200 Å] multiplet radiations were monitored simultaneously from various nighttime and daytime auroras by using two large through-put co-aligned spectrophotometers. Measurements were made around winter solstice periods at Longyearbyen (Λ=74°N), Svalbard, where large (>20°) solar depression angles, even during local midday, permitted continuous round the clock observations. Average energy of particles precipitating in auroras sighted over Longyearbyen ranged from a few keV at night to less than a hundred eV in the midday cusp section of the auroral oval; the corresponding atmospheric heights of peak auroral-energy deposition varied from around 110 km, where molecular species are the major constituents of the atmosphere, to above 200 km, where atomic species are more dominant. The intensity ratio I [5200 Å]/I [3466 Å] varied in dynamic auroras associated with large changes in auroral energy flux. (35 refs.)

Concerning sources of $O(^1D)$ in aurora: electron impact and dissociative recombination ....See Entry 69397

94.20 PHYSICS OF THE IONOSPHERE

(for planets, see 96.30)

69403 Investigation of sporadic solar radio emission and parameters of the Earth's ionosphere by Intercosmos-Copernicus 500. VI. Morphological and spectral characteristics of electron density in the ionosphere. V.I.Aksenov, G.M.Artem'eva, G.P.Komrakov, L.A.Skrebkova.
Cosmic Res. (USA), vol.20, no.4, p.383-91 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.542-51 (July-Aug. 1982). [received: April 1983]
For pt.V see Kosm. Issled., vol.18, no.5, p.740-7 (1980) or Cosmic Res., vol.18, no.5, p.536-42 (1980). Results are given for studies of inhomogeneities in the electron density obtained in 1973 using the Intercosmos-Copernicus 500 satellite. A high-frequency impedance device on the satellite (working frequencies of 3.1 and 15 MHz) provided measurements of the electron density in the innosphere in the range from 10^3 to 1.8×10^6 cm^{-3}, and inhomogeneities with sizes from 0.5 to 100 km and relative fluctuations $\Delta N/N \geq 3 \times 10^{-4}$. The probability for the appearance and intensity of inhomogeneities is studied. A spectral analysis is made of them for middle and equatorial latitudes for day-and nighttime periods during calm and disturbed geomagnetic conditions for altitudes in the ionosphere from 200 to 1500 km. (8 refs.)

69404 Variations in the intensity and anisotropy of precipitating particle fluxes with energies above 30 keV. V.I.Altyntseva, A.V.Dronov, A.S.Kovtyukh, M.I.Panasyuk, N.M.Polekh, S.Ya.Reizman, E.N.Sosnovets.
Cosmic Res. (USA), vol.20, no.4, p.392-9 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.552-9 (July-Aug. 1982). [received: April 1983]
Using Cosmos 900 data, spatial-temporal variations in the precipitation of electrons with energies of 50-80 keV and protons with energies of 210-320 keV are compared during the magnetic storm on July 29, 1977. In contrast with the protons, electron precipitation has the form of short bursts and is stronger in the morning-day sector. It is found that anisotropy in the electrons decreases as the fluxes increase, and their magnitude is limited by a critical

level. An excess of precipitating electron fluxes over quasitrapped ones has been observed in the auroral zone. (23 refs.)

69405 Measurements of the stability of energetic electron beams in the ionosphere. G.R.J.Duprat, B.A.Whalen, A.G.McNamara (Hertzburg Inst. of Astrophys., Nat. Res. Council of Canada, Ottawa, Ontario, Canada), W.Bernstein.
J. Geophys. Res. (USA), vol.88, no.A4, p.3095-108 (1 April 1983).
A Nike Black Brant V rocket was launched from the Churchill Research Range (Manitoba) on December 3, 1979, into a bright east-west oriented auroral arc. The rocket payload consisted of two separable sections, each containing its own telemetry and a full set of wave and charged particle detectors. An electron gun, carried in the main payload, produced a pulsed electron beam with energies of 1.9, 4, and 8 keV at 1, 10, and approximately 100 mA in a programed format. Charged particle observations from the flight are used to define the spatial distribution of perturbed volume surrounding the accelerator during gun firing. The radial dimensions of the perturbation were found to scale with the primary electron beam gyroradius and current and were also dependent on the beam injection angle. On magnetic field lines near the gun, the induced return electron energy spectrum is characterized by a monotonically decreasing intensity with increasing energy out to the approximate beam energy. At increasing distances across field lines the energy spectrum takes on a monoenergetic appearance peaked near the beam energy. All beam-induced electron fluxes drop rapidly to background at the edge of the perturbed volume. Other aspects of the electron beam-plasma interaction are described. (25 refs.)

69406 Observations of small-scale auroral vortices by the S3-2 satellite. W.J.Burke (Air Force Geophys. Lab., Hanscom Air Force Base, Bedford, MA, USA), M.Silevitch, D.A.Hardy.
J. Geophys. Res. (USA), vol.88, no.A4, p.3127-37 (1 April 1983).
The purpose of this paper is to present a detailed examination of two small-scale electrodynamic structures observed at low altitudes by the S3-2 satellite. Both events were detected near the dawn-dusk meridian, in the southern auroral ionosphere, during a substorm period. (33 refs.)

69407 Three-dimensional current flow and particle precipitation in a westward travelling surge (observed during the Barium-GEOS rocket experiment). H.J.Opgenoorth (Uppsala Ionospheric Obs., Uppsala, Sweden), R.J.Pellinen, W.Baumjohann, E.Nielsen, G.Marklund, L.Eliasson.
J. Geophys. Res. (USA), vol.88, no.A4, p.3138-52 (1 April 1983).
During the Barium-GEOS rocket experiment on September 24, 1979 the passage of a westward travelling surge (WTS) was observed over Scandinavia. Extended instrument networks in that area allowed simultaneous observation of the two-dimensional character of magnetic and electric field disturbances and particle precipitation associated with the auroral feature. By combination of the different datasets and additional information from particle and electric field measurements aboard the Barium-GEOS rocket it was possible to derive the two-dimensional distribution of ionospheric electric fields and conductivities and to model the three-dimensional current flow in the vicinity of the westward travelling surge. The main feature of the resulting model current system is the presence of a localized upward field-aligned current directed out of the head of the surge and fed by a westward electrojet, which is composed of both Hall and Pedersen currents. (44 refs.)

69408 Influence of the *E* region dynamo on equatorial spread *F*. W.B.Hanson, S.Sanatani (Center for Space Sci., Univ. of Texas, Richardson, TX, USA), T.N.L.Patterson.
J. Geophys. Res. (USA), vol.88, no.A4, p.3169-73 (1 April 1983).
The integrated *E* region Pedersen conductivity can be an important parameter in determining whether the bottomside of the equatorial *F* layer will be stable against the Rayleigh-Taylor gravitational instability. The *F* layer is observed to become unstable when it rises to great heights after sunset. One effect of this height rise is to decrease the stabilizing influence of ion-neutral collisions at *F* region heights. It is shown here that the same eastward electric field that raises the *F* layer also decreases the Pedersen conductivity of the *E* region, which further destabilizes convective overturning. Because the conductivity of magnetic tubes that penetrate the main *F* layer is large compared to the *E* layer contribution, these effects are important only for the bottomside of the equatorial *F* layer. (13 refs.)

69409 Conjugate studies of an isolated equatorial irregularity region. E.J.Weber (Air Force Geophys. Lab., Hanscom AFB, MA, USA), J.Aarons, A.L.Johnson.
J. Geophys. Res. (USA), vol.88, no.A4, p.3175-80 (1 April 1983).
Coordinated ground and airborne measurements were conducted at three points along the Ascension Island magnetic meridian to investigate the distribution of scintillation-producing (km scale) ionospheric irregularities within an isolated equatorial plasma depletion. Airglow measurements near the northern Appleton anomaly show that irregularities are confined to the region within a 6300-Å airglow depletion. The airglow measurements are then used to map the depletion region along magnetic field lines for comparison with scintillation measurements near the magnetic equator and near the conjugate point at Ascension Island. Results show that the irregularity region is magnetic flux tube aligned and conjugate over north-south distances of ~ 3000 km. (21 refs.)

69410 Theoretical modeling of low-latitude Mg^+. C.G.Fesen, P.B.Hays (Space Phys. Res. Lab., Univ. of Michigan, Ann Arbor, MI, USA), D.N.Anderson.
J. Geophys. Res. (USA), vol.88, no.A4, p.3211-23 (1 April 1983).
F region metal ion morphology is important because these long-lived ions act as tracers of the dynamical processes. The behavior of Mg^+ was inferred from the 2800 Å resonance emission observed by the Visible Airglow Experiment on the Atmosphere Explorer E satellite. Data were obtained over 5 months near winter solstice during solar maximum conditions. Theoretical modelling the Mg^+ densities was undertaken by solving the coupled continuity and momentum equations for one major and one minor ion. A uniform layer of 100 metal ions cm^{-3} at the lower boundary of 125 km was assumed. The calculations reproduced the observed appearance of largest metal ion densities in the early afternoon in winter solstice conditions, and number density profiles that are nearly altitude independent near the equator near noon. Longitudinal effects are apparent mainly at high altitudes ($\gtrsim 350$ km) near dusk. The influence of E-region dynamics on the F-region is studied. (41 refs.)

69411 Monte Carlo calculations of the O^+ velocity distribution in the auroral ionosphere. A.R.Barakat, R.W.Schunk, J.P.St.-Maurice (Center for Atmospheric & Space Sci., Utah State Univ., Logan, UT, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3237-41 (1 April 1983).
The O^+ velocity distribution in the high latitude *F* region has been calculated by using a Monte Carlo technique. The calculations were restricted to the altitudes where O^+-O collisions dominate, i.e. between about 200-350 km. The Monte Carlo calculations confirm the earlier predictions, which were based on a simple relaxation collision model, that the O^+ velocity distribution takes a toroidal shape for large convection electric fields. However, the toroidal features appear only for electric fields greater than about 80-100 mV/m when a more rigorous ion neutral collision model is used, whereas the relaxation collision model predicted toroidal features for electric fields greater than about 40 mV/m. Since a toroidal velocity distribution is unstable, ionospheric irregularities can be expected at altitudes between 200-350 km when the convection electric field exceeds 80-100 mV/m. (19 refs.)

69412 Ionospheric plasma cloud dynamics via regularized contour dynamics. I. Stability and nonlinear evolution of one-contour models. E.A.II.Overman, N.J.Zabusky (Dept. of Math. & Statistics, Univ. of Pittsburgh, Pittsburgh, PA, USA), S.L.Ossakow.
Phys. Fluids (USA), vol.26, no.4, p.1139-53 (April 1983).
The linear stability and nonlinear evolution of a regularized contour dynamical model of an ionospheric plasma cloud (or deformable dielectric) is examined. That is, the cloud is modeled by piecewise-constant ion density regions and the regularization is accomplished with a tangential diffusion operator that models aspects of the diffusion operator in two dimensions. A complete linear stability analysis of a circular cloud shows that a single-mode excitation 'cascades downward' in wavenumber as it grows in amplitude, a process that results from the symmetry-breaking electric field. Approximate formulas are derived for the amplitude growth and cascade-down phenomena and verified with precise numerical calculations. A simple rescaling shows that clouds with large λ (=cloud-ion density/ambient-ion density) evolve more slowly and appear more dissipative. The regularized contour-dynamical algorithm for computations in the nonlinear regime is validated against the linear analysis and truncation errors are assessed by using different spatial resolutions. Calculations in the nonlinear regime show the experimentally observed 'backside' striations. Furthermore, at long times, a secondary structure arises on the sides of the primary striations. A comparison of simulations with different λ shows that nonlinear effects arise sooner in normalized time (but longer in real time) if λ is larger. (26 refs.)

69413 Controlled stimulation of magnetospheric electrons by radio waves: experimental model for lightning effects. R.A.Goldberg, S.A.Curtis (Lab. for Planetary Atmospheres, NASA/Goddard Space Flight Center, Greenbelt, MD, USA), J.R.Barcus, C.L.Siefring, M.C.Kelley.
Science (USA), vol.219, no.4590, p.1324-7 (18 March 1983).
Magnetospheric electrons precipitated by ground-based coded very low frequency radio transmissions have been detected by rocket measurement of bremsstrahlung X-rays, caused by impact of the electrons with the upper atmosphere. The direct correlations obtained between the very low frequency signals and the X-rays demonstrate the limits of sensitivity required and indicate that this remote sensing technique would be useful for future study of very low frequency effects induced by single lightning strokes. (18 refs.)

69414 The connection between radiation belt and auroral processes. J.M.Cornwall (Dept. of Phys., Univ. of California, Los Angeles, CA, USA).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.235-43 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The aurora with its associated electric fields and energetic particles affects the structure of the ionosphere, plasmaphere, and ring current. It injects protons and heavier ions (He^+, O^+) into the magnetosphere which can yield energy to or absorb energy from the ring current and plasmasphere via electromagnetic ion-cyclotron interactions. Its parallel electric fields are determined by perpendicular convection electric fields, which may (on a sufficiently long time scale) be themselves strongly affected by the ring current. The authors briefly review some of these connections, with emphasis on the relationship between between parallel potential drops and the gross convection pattern. (33 refs.)

69415 Plasmasphere and its interaction with the ring current. K.I.Gringauz (Inst. for Space Res., Moscow, USSR).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.245-57 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
In the last few years (after 1976) new instruments have been used for plasmaspheric studies ('mutual-impedance' probe, ion energy-mass spectrometers) which have led to new results. The existence in the plasmasphere of previously unknown ions (He^{2+}, O^{2+}) was revealed and the pitch-angle distributions of ions with energies 10-20 eY were measured. New measurements confirmed the existence of a 'hot' ('warm') zone in the outer plasmasphere and of a midday-midnight asymmetry of the plasmasphere. The source of outer plasmasphere heating is apparently the ring-current decay; electrons are heated less than ions. The plasmasphere is not only the medium of ring current decay, but it appears that it is one of the ring-current ion sources. (25 refs.)

69416 Electric fields in the ionosphere and magnetosphere. R.A.Greenwald (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.305-15 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Reviews low altitude observations of the high latitude convection electric field as obtained with a variety of instruments including polar orbital spacecraft, barium, incoherent and coherent scatter radars, and ground-based magnetometers. There still appears to be some contradiction in the observations, particularly with regard to plasma flow into and out of the polar cap. Also there does not appear to be any simple relationship between the sign of B_y and the local time location of the throat region. Rather, under active conditions, it appears that the plasma entry and exit regions rotate towards earlier times and there is a significant component of dawn-dusk now across the polar cap. Superimposed on this may be some B_y-dependence of the plasma entry region. (27 refs.)

69417 Dynamics of the disturbed ionosphere. H.Volland (Radioastron. Inst., Univ. of Bonn., Bonn, Germany).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.327-35 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The ionospheric storm process at *F* layer heights is reviewed and an explanation in terms of wind-induced diffusion of atomic oxygen is given. (15 refs.)

69418 Ionospheric disturbances resulting from ion-neutral coupling. J.G.Luhmann (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.337-46 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Recent advances in subjects related to ion-neutral coupling in the disturbed ionosphere are summarized. Areas of emphasis include traveling ionospheric disturbances, ionospheric irregularities and the atmospheric dynamo. (63 refs.)

69419 Meteorological control of the D region. J.Taubenheim (Central Inst. of Solar-Terrestrial Phys., Berlin-Adlershof, Germany).
Space Sci. Rev. (Netherlands), vol.34, no.4, p.397-411 (April 1982). [received: April 1983] (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
After a short review of the characteristics of the ionized state and meteorology of the mesopause region, the winter anomaly of the *D* region electron density and its variability are described as manifestations of meteorological control. A major mechanism is the redistribution of nitric oxide, another important mechanism is the strong temperature dependence of cluster ion formation rates. The meteorological control can be described either in a 'concerted' scenario of more or less independently acting mechanisms, or in a 'unitary' scenario where all mechanisms are regarded as effects of a common cause, viz. the strong winter vortex circulation of the middle atmosphere. (41 refs.)

69420 Simplified evaluation of propagation characteristics for HF radio waves reflected from the ionospheric F2 layer. M.Lockwood (Rutherford Appleton Lab., Chilton, England).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.233-7 part 2
New algorithms are presented for the rapid evaluation of ordinary-wave, basic maximum usable frequency (MUF) and mirror-reflection height (h_T) of F2-layer skywave modes, in terms of input parameters regularly scaled from ionograms. The errors in the values calculated by these algorithms are assessed. Comparisons are made with existing simplified procedures, having regard to method complexity and evaluation time. (10 refs.)

69421 Prediction and observation of HF propagation modes and signal intensities. J.Caruana.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.238-43 part 2
Compares some observations of sky-wave propagation modes and their signal intensities with predictions generated by the Australian Ionospheric Prediction Service (IPS) pathloss computer program. The predicted quantities are the monthly median values of either the available signal power at the input to the receiver of the RMS field strength at the antenna of the receiver. The recorded data were obtained from the Defence Research Centre at Salisbury, Australia (DRCS), and from the CCIR Data Bank. The IPS pathloss program is based on the second CCIR interim method of making signal intensity predictions. IPS uses its own world grid-point maps of ionospheric characteristics and basic MUF formulae. (7 refs.)

69422 Short-term variability in HF radio wave absorption at Camden (34°S, 151°E). B.G.Ferguson.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.244-8 part 2
The short-term variability (occurring on time scales of minutes to hours) in the amplitude of the single frequency A1 measurements obtained at Camden during 1980 was found to be associated with changes in the deviative absorption. This variability was observed to be diurnally and seasonally dependent, being most prevalent in the afternoon around the equinoxes and essentially absent in summer. The source of this variability (the effects of which pervade the data) is enhanced electron-density gradients (ledges) occurring at the base of the E region which perturb the normal E region electron-density profile and cause the absorption to decrease by 10-30 dB. The variability in HF radio wave absorption is probably linked with dynamical processes occurring in the E region of the ionosphere. The other parameters affecting absorption, namely the electron-neutral collision frequency, together with the intensity and direction of the earth's magnetic field, are not considered important in the present study because their variations occur on much longer time scales (months to years). (11 refs.)

69423 A revised set of coefficients to represent the global variation of foF2. C.M.Rush, M.PoKempner, D.Anderson, F.Stewart, J.Perry.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.249-53 part 2
Briefly describes the process used to determine the new coefficients for foF2 and to illustrate the improvement in specifying foF2 using the new coefficients. (15 refs.)

69424 Predicting BBC external broadcasting HF transmissions by minicomputer. R.Fricker.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.254-8 part 2
The External Services of the BBC have been broadccsating HF skywave transmission for many years, and for the planning of these it is useful to have a prediction method which can be carried out by a minicomputer. The method can predict the regularity of the propagation and the field strength of transmissions from any location to any other location for any month of the year and for any sunspot number. A method for use on a programmable calculator has been developed and adapted for use on a minicomputer. The method has been extended for use up to 10 hops on the F layer, and up to 30000 kms. Predictions are made for the centre transmission frequency in each of the nine broadcasting bands, and at intervals of every two hours throughout the twenty four, with the option of predicting for a given time or times. (1 ref.)

69425 'The boundary fence'—limits to bistatic auroral field aligned propagation over large areas of Europe. C.E.Newton.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.259-62 part 2
Concerns the maximum range limitations that the auroral mode imposes on participating stations. Only contacts in excess of 800 kilometres are used. For convenience it has been assumed that 'E' layer aurora is at 110 kilometres height, for which the isoflectional maps have also been drawn, and the operating frequency is in the VHF two-metre amateur band (144-146 megahertz). (4 refs.)

69426 Dynamics of the ionosphere during disturbed conditions. A.K.Barbara, M.Devi, P.Bardoloi, K.Rahman (Dept. of Phys., Gauhati Univ., Assam, India).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.263-7 part 2
Using amplitude and phase data of Radio Beacons at 140 and 136 MHz from ATS 6 and ETS II taken at Gauhati (26.20°N; 91.75°E), an attempt has been made to study the dynamics of the ionosphere during highly disturbed conditions (i) during the solar eclipse of Feb. 16, 1980 and (ii) during the severe geomagnetic storm of Dec. 19, 1980. The two events have caused drastic changes in the normal ionospheric conditions in different ways, but from analysis of the structures, periodic fluctuations and temporal variations of the irregularities, it is concluded that large and small scale irregularities generated during both the disturbed conditions came possibly from the same origin. (15 refs.)

69427 Ionospheric indices for monthly and daily use. P.J.Wilkinson.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.268-72 part 2
The derivation of monthly ionospheric indices is reviewed and then applied to daily data to obtain daily global ionospheric indices. Some applications of the daily indices to forecasting are then discussed. (7 refs.)

69428 Long term variation of the noon-time critical frequency of the F 2 layer of the ionosphere over Delhi in relation to sun-spot numbers and 10 cm solar flux. C.S.R.Rao (Res. Dept., All India Radio, New Delhi, India).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.273-5 part 2
An analysis of the noon-time frequency of the F2 layer of the ionosphere over Delhi from 1948 to 1981 is studied in relation to the corresponding variations in the sunspot numbers and 10 cm solar flux. (4 refs.)

69429 Estimation of ionospheric cross-modulation. N.M.Maslin.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.299-303 part 2
Provides a brief overview of the physical processes involved in the phenomenon, outlines a simple theory, discusses and reviews its limitations, and provides a more reliable method of predicting the likely cross-modulation effects produced on broadcast transmissions. (20 refs.)

69430 Nonlinear effects in the ionospheric propagation of high power radio waves. T.B.Jones, T.Robinson (Univ. of Leicester, Leicester, England), P.Stubbe, H.Kopka.
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.304-7 part 2
Describes some observations of nonlinear effects associated with the generation of FAI by highpower radio waves, and provides an explanation of the phenomena involved in terms of current theory. The physical processes which give rise to the observed effects are outlined in order to provide a basis for the presentation of the experimental results in the subsequent sections. (11 refs.)

69431 Long distance reception of TV signals through ionosphere. T.C.Ramadorai, C.S.R.Rao (Res. Dept., All India Radio, New Delhi, India).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.318-20 part 2
The Delhi (28°40′N; 77°10′E) Television transmitter operates on band-I channel-4 (video 62.25 MHz, sound 67.75 Mhz) with 50 kw ERP and effective antenna height of 87 m. Rohtak (28°55′N; 76°25′E) is situated at about 65 Km towards North West of Delhi and gets a median field strength of 30 to 40 dB (uv/m) from the Delhi TV Transmitter. TV viewers in the Rohtak area complained of interference in the reception of the Delhi channel. Investigations revealed that the interfering transmitter operates on channel-3 with the signal strength of 30 to 35 dB (uv/m) and causes interference to upper adjacent channel due to insufficient protection ratio. (5 refs.)

69432 Interference for sporadic-E propagation at frequencies around 70 MHz. K.J.Edwards, L.Kersley, L.F.Shrubsole (Univ. of Coll. of Wales, Aberystwyth, Wales).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.321-4 part 2
While an extensive observational campaign to investigate the occurrence of sporadic-E propagation on lower Band I television frequencies was carried out by the European Broadcasting Union in the 1960s, at higher frequencies little is available to guide the spectrum planner. The authors discuss observations within the frequency range 59.25 to 77.25 MHz which have been made on a near-continuous basis since 1972. (4 refs.)

69433 Experimental results for the 144 MHz transequatorial propagation in the Euro-African sector. C.G.Fimerelis, N.K.Uzunoglu (Nat. Tech. Univ. of Athens, Athens, Greece).
Third International Conference on Antennas and Propagation ICAP 83, Norwich, England, 12-15 April 1983 (London, England: IEE 1983), p.325-8 part 2
Some new experimental TEP results are reported specifically for the top 144 MHz frequency band and for radio circuits between Athens (Greece), Limassol (Cyprus) on Europe and Harare (Zimbabwe), Pretoria (S Africa) on Africa. Parameters such as circuit reliability, duration and signal strength during the 'openings' signal fading and spreading are presented for the three radio circuits. The geographic areas where the 'mean' TEP is observable is also discussed. (5 refs.)

Fifth International Symposium on Solar-Terrestrial Physics ....See Entry 64584

Solar variability and minor constituents in the lower thermosphere and in the mesosphere ....See Entry 69398

A rocket observation of the 6300 Å/5200 Å intensity ratio in the dayside aurora: implications for the production of $O(^1D)$ via the reaction $N(^2D)+O_2 \rightarrow NO+O(^1D)$ ....See Entry 69401

Neutral sheet current interruption and field-aligned current generation by three dimensional driven reconnection ....See Entry 69435

Generation of lower hybrid waves by inhomogeneous electron streams ....See Entry 69443

Numerically simulated two-dimensional auroral double layers ..See Entry 69444

Electric currents and voltage drops along auroral field lines ... See Entry 69452

Solar-wind disturbances and the solar wind-magnetosphere energy coupling function ....See Entry 69472

94.30 PHYSICS OF THE MAGNETOSPHERE

(for planets, see 96.30)

69434 Exit of boundary layer plasma from the distant magnetotail. W.J.Heikkila (Center for Space Sci., Univ. of Texas, Richardson, TX, USA).
Geophys. Res. Lett. (USA), vol.10, no.3, p.218-20 (March 1983).
It is pointed out that the boundary layer plasma must somehow leave the magnetospheric system. It is proposed that the boundary layers on the dawn and dusk flanks are continued into the far magnetotail, becoming joined together far downstream, still on closed magnetic field lines. Within the com-

bined layer there would be a dusk to dawn electric field for antisunward convection (as is the case for the boundary layers on the dawn and dusk flanks nearer to the earth). It is suggested that the boundary layer flow is so massive that the flow itself can generate the right electric field for continued flow. Most of the plasma in the mantle over the polar caps would also be convected out in a similar manner, rather feeding the plasma sheet. There would be a stagnation point inside the magnetotail, with any boundary or mantle plasma diffusing earthward of this point becoming the plasma sheet. It is deduced that no steady state solution is possible. (18 refs.)

69435 Neutral sheet current interruption and field-aligned current generation by three dimensional driven reconnection. T.Sato (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA), T.Hayashi, R.J.Walker, M.Ashour-Abdalla.
Geophys. Res. Lett. (USA), vol.10, no.3, p.221-4 (March 1983).
The authors have simulated externally driven reconnection by solving the magnetohydrodynamic equations in a three-dimensional, tail-like geometry. As reconnection proceeds, the tail current is interrupted locally and field aligned currents are generated. The field aligned current flows towards the ionosphere on the morning side and away from the ionosphere in the evening. The field aligned currents flow in a narrow band at the outer edge of the plasma sheet. Thus, the simulation demonstrates that the nightside substorm current system is a natural consequence of the driven reconnection model. (26 refs.)

69436 Charge neutrality and plasma distribution function in a dipole magnetic field. R.Rajaram, M.Roy (Indian Inst. of Geomagnetism, Bombay, India).
Indian J. Pure & Appl. Phys., vol.20, no.10, p.804-7 (Oct. 1982). [received: April 1983]
The problem of charge neutrality in a low-density plasma trapped in a dipole magnetic field and subjected to a weak electric field (normal to the magnetic field) has been examined. It has been argued that the braking of the electric field can result in the build-up of charge separation unless the redistribution of protons and electrons in the system continuously neutralizes it. The restriction that this imposes on the possible forms of the distribution function has been reduced and discussed. The geophysical relevances of the results obtained have also been presented. (9 refs.)

69437 Lower hybrid drift instability with temperature gradient in a perpendicular shock wave. Y.M.Zhou, H.K.Wong, C.S.Wu (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), D.Winske.
J. Geophys. Res. (USA), vol.88, no.A4, p.3026-34 (1 April 1983).
The lower hybrid instability is studied in the perpendicular bow shock geometry including finite beta effects and an electron temperature gradient. The flute ($k_\parallel=0$) mode, which for constant electron temperature is stable at the shock, is destabilized for sufficiently large temperature gradient ($\epsilon_T \rho_i \gtrsim 1$). Numerical solutions are presented for cases in which the ion distribution is either a drifting Maxwellian or consists of two Maxwellians to represent the effect of reflected ions at the shock. Implications of the results concerning ion and electron heating and electron acceleration at the bow shock are also discussed. (39 refs.)

69438 Stability of electron distributions within the Earth's bow shock. M.F.Thomsen, H.C.Barr, S.P.Gary, W.C.Feldman, T.E.Cole (Earth & Space Sci. Div., Los Alamos Nat. Lab., Los Alamos, NM, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3035-45 (1 April 1983).
The linear Vlasov stability of a class of electron velocity distributions which model those observed within the Earth's bow shock is examined. The study is restricted to electrostatic waves which propagate parallel to the ambient magnetic field **B**. Two instabilities are identified which are driven by free energy in the direction parallel to **B**: an ion acoustic wave with real frequency below the ion plasma frequency and an electron acoustic wave with real frequency of several times the ion plasma frequency. The characteristics of the unstable waves are in accord with obvervations obtained within the bow shock, in particular, with the trend of the observed electrostatic waves to be polarized parallel to the magnetic field. The instabilities identified may contribute to electron dissipation in collisionless shocks. (12 refs.)

69439 A source of the backstreaming ion beams in the foreshock region. M.Tanaka (Inst. for Phys. Sci. & Technol., Univ. of Maryland, College Park, MD, USA), C.C.Goodrich, D.Winske, K.Papadopoulos.
J. Geophys. Res. (USA), vol.88, no.A4, p.3046-54 (1 April 1983).
A new source mechanism is proposed for the 'reflected' ion beams observed in the foreshock region of the Earth's bow shock. In this model the beams originate in the magnetosheath downstream of the quasi-perpendicular portion of the shock. The quasi-perpendicular shock transition is characterized by two downstream ion populations including high-energy gyrating ions in addition to the directly transmitted anisotropic ions. The authors show by particle simulations that this highly anisotropic downstream ion distribution ($T_\perp/T_\parallel \gg 1$) can excite electromagnetic ion cyclotron waves which, in turn, pitch angle scatter the gyrating ions in a few ion gyroperiods. As a result, some ions acquire large parallel velocities and move fast enough along the convecting downstream magnetic field to escape back across the bow shock into the upstream region. The distribution of escaping ions calculated by using the pitch-angle-scattered ions, as a source, becomes a beam with a large temperature anisotropy $T_\perp \sim 3\text{-}5\ T_\parallel$ and a mean velocity along the magnetic field of about twice that of the solar wind velocity. (30 refs.)

69440 Characterization of geostationary particle signatures based on the 'injection boundary' model. B.H.Mauk, C.-I.Meng (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3055-71 (1 April 1983).
To lend further support to the 'injection boundary' concept, this paper characterizes the details of geostationary particle signatures using a very simpleminded analysis procedure. The signatures are generated using the time of flight effects which evolve from an initial sharply defined, double-spiraled boundary configuration. By using only the most fundamental characteristics of standard convection configurations, the very complex and highly variable dispersion patterns frequently observed by geostationary satellites are successfully reproduced. In particular, seven distinctly different ion-electron paired dispersion patterns on energy versus time spectrograms (1 eV to 100 KeV) are predicted, and all seven of these are observed on a regular basis by both the SCATHA satellite (in the near geostationary orbit) and the ATS-6 satellite. It is concluded that most dynamical dispersion features (including energetic ion and electron echoes) can be mapped to the double-spiral boundary without further ad hoc assumptions. (23 refs.)

69441 Computer simulation of whistler mode wave-particle interactions using a free-boundary encounter model. K.Hashimoto (Dept. of Electrical Engng., Kyoto Univ., Kyoto, Japan), H.Matsumoto, Y.Serizawa, I.Kimura.
J. Geophys. Res. (USA), vol.88, no.A4, p.3072-8 (1 April 1983).
Computer simulations of whistler mode wave-particle interactions have been performed by using a free-boundary encounter model electromagnetic code. The free boundary is attained by adding a collision dominated damping region near one boundary to remove periodicities usually used in electromagnetic codes. In this model, a wave front encounters a resonant bi-Maxwellian hot electron beam. Spatial amplitude modulations are observed in this simulation. The dips of the amplitude, however, sometimes decrease to zero levels. The null points of the wave magnetic field and the associated phase reversals of the wave cannot be described by the usual particle trapping theory. A component of the field contains a feature reminiscent of a double sideband (DSB) wave without a carrier. This is interpreted as a beat between an incident wave and a generated wave. (15 refs.)

69442 Electrostatic bursts generated by electrons in Landau resonance with whistler mode chorus. L.A.Reinleitner, D.A.Gurnett, T.E.Eastman (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3079-93 (1 April 1983).
Recent studies of wideband plasma wave data from the ISEE 1 and ISEE 2 spacecraft have revealed that whistler mode chorus emissions in the Earth's outer magnetosphere are often accompanied by high-frequency bursts of electrostatic waves with a frequency slightly below the electron plasma frequency. Investigations have shown that in some cases the electrostatic waves are modulated at the chorus frequency. Further studies indicate that these bursts are produced by a 'beam' of electrons in Landau (longitudinal) resonance with the chorus wave and thus moving at the chorus phase velocity. A threshold exists in the chorus intensity below which the electrostatic bursts do not appear. The high-frequency electrostatic waves are believed to be caused by a type of two-stream instability called the resistive medium instability. The resistive medium instability is characterized by a reduction in the electrostatic burst frequency below the electron plasma frequency. (32 refs.)

69443 Generation of lower hybrid waves by inhomogeneous electron streams. M.J.Keskinen, J.D.Huba (Plasma Phys. Div., Naval Res. Lab., Washington, DC, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3109-15 (1 April 1983).
A linear, electrostatic, kinetic theory of velocity-sheared inhomogeneous electron streams flowing parallel to a magnetic field is presented. This development, which includes the effects of a density gradient, background plasma, and electron collisions, is valid for arbitrary T_{es}/T_i and T_{eb}/T_i, where T_{es}, T_{eb}, and T_i are the temperatures of the sheared electrons, background electrons, and background ions, respectively. For hot electron streams $T_{es}/T_i \gg 1$ and $T_{es} \gg T_{eb}$, the authors find a new resonant instability driven by velocity shear with freqeuncy near the lower hybrid frequency. This mode is characterized by wave numbers k such that $kr_{Les} \lesssim 1$, where r_{Les} is the sheared electron gyroradius and is damped by collisional effects. Application is made to wave turbulence in the auroral zone and solar corona. (29 refs.)

69444 Numerically simulated two-dimensional auroral double layers. J.E.Borovsky, G.Joyce (Dept. of Phys. & Astron., Univ. of Iowa, Iowa City, IA, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3116-26 (1 April 1983).
Electrostatic plasma double layers are numerically simulated by using a magnetized $2^1/_2$ dimensional particle-in-cell system, periodic in one direction and bounded by reservoirs of Maxwellian plasma in the other. The simulations of both oblique and two-dimensional double layers show periodic instability, indicate Debye length rather than gyroradii scaling, and reveal low-frequency electrostatic turbulence and electron beam excited electrostatic electron-cyclotron waves. Simulated electric field and electron beam data resemble referenced satellite measurements of oppositely directed electric fields within auroral regions and of precipitating electrons in inverted v events. Estimates are given for the thicknesses of auroral double layers and for the separations within multiple auroral arcs. The temporal modulation of accelerated beams is investigated. Simulations including the atmospheric backscattering of electrons predict the presence of an ionospheric sheath that acts to accelerate ionospheric ions upward. (21 refs.)

69445 Upstream waves and particles. C.T.Russell, M.M.Hoppe (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.155-72 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The region upstream from terrestrial, planetary, and interplanetary shocks in which the magnetic field lines are connected to the shock is filled with a variety of plasma waves, MHD waves, energetic electrons, and ions associated with the near presence of the shock. These upstream waves and particles present the researchers with a natural plasma laboratory which is providing basic information on plasma instabilities and collisionless shock physics, as well as insight into how cosmic ray acceleration may occur in the interstellar medium. Much remains to be done, however, before present empirical knowledge is woven into the stronger fabric of theoretical understanding. (58 refs.)

69446 IMF control of the Earth's magnetosphere. A.Nishida (Inst. of Space & Astronautical Sci., Tokyo, Japan).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.185-200 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Recent progress in the understanding of the IMF control on the Earth's magnetosphere through the reconnection process is reviewed. Major points include (1) the identification of the magnetopause structure under the southward IMF polarity to be the rotational discontinuity and the resulting interference that the reconnection line is formed in the equatorial region, and (2) the confirmation from several observational aspects that under the northward IMF the reconnection takes place in the polar cusp. The point (1) is consistent with the observed correlations of geomagnetic indices with IMF but raises an important theoretical issue, and the point (2) is accompanied by an interesting issue of explaining why the polar cap electron precipitation is more energetic under such IMF conditions. Critical studies have reaffirmed the view that the energy supplied by reconnection is partly transported directly to the ionosphere to drive the DP-2 type current system but at the same time it is partly stored in the magnetic field of the tail to be unloaded 0.5~1 hr later to produce the expansion phase of substorm. (51 refs.)

69447 Magnetic structure of the boundary layer. E.W.Hones,Jr. (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.201-11 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
It now appears that magnetospheric convection is driven by both magnetic reconnection and 'viscous' dragging of closed flux tubes acting in varying proportions but with reconnection being, on the average, the predominant cause. But the action of the closed flux tubes of the low latitude boundary layer seems predominant in driving system 1 field aligned currents and discrete auroras. A search of ISEE boundary layer data for the magnetic shear effects associated with field aligned currents has revealed, on some occasions, a 'reverse draping' of boundary layer field lines whose cause might be plasma entry around the cusps, a north-south asymmetry in current flow to the polar regions, or magnetic reconnection at high latitudes. Observed asymmetries in the nature and distribution of boundary layer encounters suggest that the boundary layer and/or the plasma mantle may differ substantially at the

dawn and dusk sides of the magnetosphere and that there may be seasonal dependencies of their properties. (12 refs.)

69448 Plasma processes within the magnetosphere boundaries. A.A.Galeev (Space Res. Inst., Acad. of Sci., Moscow, USSR).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.213-20 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
A brief summary is presented of recent progress in estimating the rates of energy, momentum and mass transport of the solar wind through the magnetopause in terms of an analysis of the nonlinear stage of various plasma instabilities. It is shown that the energy supply to the Earth's magnetosphere is due to reconnection on the dayside magnetopause and its dissipation during magnetospheric substorms, being controlled by both the interplanetary field parameters and by the dynamic pressure of the solar wind. (30 refs.)

69449 The Earth's ring current: causes, generation, and decay. D.J.Williams (Appl. Phys. Lab., Johns Hopkins Univ., Laurel, MD, USA).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.223-34 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The development of currents due to arbitrary distributions of trapped particles in the geomagnetic field is described. These currents form the Earth's ring current and are responsible for world wide decreases of the surface magnetic field observed during magnetic storms. It is shown that the relative abundances of the ions forming the ring current are not yet known. Because of this it is not known how various sources mix to produce the ring current. Several possible generation mechanisms are discussed. Finally, the decay of the ring current is discussed and is shown to be due primarily to charge exchange with important secondary effects attributable to wave-particle interactions. (39 refs.)

69450 Wave generation in the terrestrial magnetosphere. D.J.Southwood (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.259-70 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The Earth's magnetosphere supports a large variety of plasma wave phenomena covering nine decades of frequency from 10^{-3} Hz to 10^{-3} Hz. Understanding why waves occur when and where they do involves sorting out the subtle interplay between the background macroscopic features of the system, the geometry, the large scale flow, etc., and the microphysics of the plasma populations that take part. The convection induced by the solar wind produces pathological plasma phase space distributions because collisions are unimportant. Such distributions may have steep spatial gradients, inverted energy distributions or strong pitch angle anisotropy, any of which can act as a free energy source for plasma waves. Large currents along the magnetic field transmit stresses between magnetosphere and ionosphere. If the electrons carrying such currents have high enough drift velocity, waves are generated. Several very different examples of magnetospheric wave generation are reviewed. (62 refs.)

69451 Wave particle interactions as an energy transfer mechanism between different particle species. R.Gendrin (Centre de Recherches en Phys. de l'Environnement, CNET, Issy-les-Moulineaux, France).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.271-87 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Recent improvements in experimental techniques and cooperative data analysis efforts have brought a lot of information on the basic mechanisms by which energy can be exchanged between different particle species in the collisionless magnetospheric or solar wind plasmas. Some of these mechanisms are reviewed. A particular emphasis is put on interactions which occur in the equatorial magnetosphere between energetic protons and electromagnetic ultra low frequency (ULF) waves and which are linked with He^+ ion trapping and heating as well as with field-aligned suprathermal electron beam generation. The process by which ion conic distributions are produced by electrostatic ion cyclotron waves generated at high altitude along auroral field lines by drifting electrons is also discussed. (68 refs.)

69452 Electric currents and voltage drops along auroral field lines. D.P.Stern (Planetary Magnetospheres Branch, Goddard Space Flight Center, Greenbelt, MD, USA).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.317-25 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The current state of knowledge concerning Birkeland currents ($j_\parallel$) and parallel electric field ($E_\parallel$) is briefly reviewed. Four types of $j_\parallel$ are discussed—the primary 'region 1' sheets, the 'region 2' sheets which parallel them and which seem to close in the partial ring current, the cusp currents which appear to correlate with interplanetary B_y, and the 'Harang filament'. The energy required by $E_\parallel$ and by the associated particle acceleration processes seems to be derived from $j_\parallel$. Much of the evidence for $E_\parallel$ comes from particles, from 'inverted V' spectra, rising ion beams and expanded loss cones, while 'conics' may signify acceleration by Electrostatic Ion Cyclotron (EIC) waves, associated with beams accelerated by $E_\parallel$. Different theoretical studies predict for $E_\parallel$ a smooth, disordered or abrupt structure, and evidence for all 3 types can be deduced from S3-3 electric field probe observations. (34 refs.)

Fifth International Symposium on Solar-Terrestrial Physics ....See Entry 64584

Variations in the intensity and anisotropy of precipitating particle fluxes with energies above 30 keV ....See Entry 69404

Controlled stimulation of magnetospheric electrons by radio waves: experimental model for lightning effects ....See Entry 69413

The connection between radiation belt and auroral processes ..See Entry 69414

Plasmasphere and its interaction with the ring current ....See Entry 69415

Electric fields in the ionosphere and magnetosphere ....See Entry 69416

Ion acceleration at shocks in interplanetary space: a brief review of recent observations ....See Entry 69471

Solar-wind disturbances and the solar wind-magnetosphere energy coupling function ....See Entry 69472

Coronal disturbances and their terrestrial effects ....See Entry 69587

94.40 COSMIC RAYS

Fifth International Symposium on Solar-Terrestrial Physics ....See Entry 64584

94.40C Origin and propagation outside the solar system

69453 Cosmic rays from binary neutron stars. W.Kundt (Inst. fur Astrophys., Univ. Bonn, Bonn, Germany).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.59-66 (Feb. 1983).
Revives the suggestion that neutron stars are the dominant source of high-energy cosmic rays. To be more precise: the (relativistic) ionic component of the cosmic rays is argued to be injected by young binary neutron stars ($\lesssim 10^5$ yr) whose rotating magnetospheres act like grindstones in the wind of their companion (Kundt, 1976). The high-energy ($\gtrsim 30$ GeV) electron-positron component may be generated by young pulsars ($\lesssim 10^5$ yr) and by collision processes and the electron component below 30 GeV predominantly by supernova remnants. (33 refs.)

Cosmic-ray abundances of Sn, Te, Xe, and Ba nuclei measured on HEAO 3 ....See Entry 69461

Observations of the interacting galaxy pair NGC 4490/85 .....See Entry 69717

94.40E Interplanetary propagation and effects

69454 Diffusion of low-energy electrons as a function of the position of outburst relative to the interplanetary current sheet. M.A.Zel'dovich, O.M.Kovrizhnykh, M.A.Livshits.
Cosmic Res. (USA), vol.20, no.4, p.399-404 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.560-5 (July-Aug. 1982). [received: April 1983]
A correlation is found between the maximum flux of electrons more energetic than 30 keV produced by solar flares and the maximum intensity of decimetric radio-bursts. It is shown that the conditions for diffusion are most favorable when the flares are distributed near the projection of a sector boundary on the solar surface. On the other hand, with flares located in the center of a sector in a local region of magnetic field with the opposite sign from that of the sector, the electron flux is noticeably weakened. (14 refs.)

69455 Cosmic ray modulations related to the interplanetary magnetic field intensity. S.P.Duggal, M.A.Pomerantz, R.K.Schaeffer, C.H.Tsao (Franklin Inst., Univ. of Delaware, Newark, DE, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.2971-81 (1 April 1983).
Data covering a complete solar cycle (1965-1976) have been analyzed in a comprehensive investigation of the nature of transient modulations of relativistic galactic cosmic rays associated with interplanetary magnetic field intensity excursions in the vicinity of the Earth. The correlation coefficient between the cosmic ray intensity and the IMF magnitude is small, in fact it remains less than 0.5 throughout the solar cycle. In order to understand the nature of field-related modulations and to minimize the complications arising from the effects of other features of solar plasma, the data are here analyzed by the method of superposed epochs. It is demonstrated that, while the days characterized by high IMF magnitude B are associated with intensity decreases, the IMF rarefactions (low B) cause an increase in the flux. Maximum cosmic ray intensity variations associated with both high and low B occur 1 day after the key days characterized by field departures from average values. This indicates that the modulation mechanism becomes efficient only when the plasma engulfment of the Earth extends at least a gyroradius beyond 1 AU. The results suggest that, on average, interplanetary magnetic field intensity variations which are presumably related to disturbances traveling from the Sun are effective transient modulators of the relativistic particles and that the corotation of the modulating region plays a significant role in the recovery of the cosmic ray intensity. (40 refs.)

69456 Theoretical studies of interplanetary propagation and acceleration. J.J.Quenby (Blackett Lab., Imperial Coll., London, England).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.137-53 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Studies evaluating the transport coefficients for energetic particles in interplanetary space are described in relation to particle data. In position space, the main mode of propagation is along field lines but perpendicular diffusion and drift motion are also possible. Diffusion coefficients based on interplanetary magnetic field data are either derived from quasi-linear, adiabatic theory or this theory corrected for finite scattering near 90° pitch angle or by numerical techniques. Relevant particle data includes solar proton event time profile and anisotropy measurements. In general, when Fokker-Planck transport equations solutions are fitted to particle data, the parallel diffusion coefficients obtained still appear rather larger than those given by theoretical estimates. Perpendicular diffusion is shown to be due to field line wandering and random drift motion effects. The importance of drift motion in cosmic ray modulation theory is mentioned. (108 refs.)

MHD structure of an interplanetary stream from Prognoz-7 measurements of the plasma and magnetic field (STIP Interval Number VI, April 25, 1979) ....See Entry 69457

Solar cycle variations of cosmic ray intensity and large-scale structure of the heliosphere ....See Entry 69459

94.40H Energetic solar particles and photons

69457 MHD structure of an interplanetary stream from Prognoz-7 measurements of the plasma and magnetic field (STIP Interval Number VI, April 25, 1979). G.N.Zastenker, A.N.Omel'chenko, E.G.Eroshenko, K.G.Ivanov, V.A.Styazhkin.
Cosmic Res. (USA), vol.20, no.4, p.404-10 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.566-71 (July-Aug. 1982). [received: April 1983]
Studies the MHD structure of the interplanetary stream on April 25, 1979 by means of measurements of the plasma and magnetic field on the near-Earth spacecraft Prognoz-7. Particular attention is paid to the interaction region between the fast stream (presumably from a low latitude coronal hole) and the slow solar wind. An especially large discontinuity (the stream boundary) divides the interaction region into a forward shock wave with dense hot ($\beta > 1$) turbulent magnetoplasma, and a reverse shock wave with a strong regular magnetic field and cold ($\beta \ll 1$) plasma. (17 refs.)

69458 Variation of the intensity of ultrahigh energy γ-rays with altitude. lu Sui-Ling, Su Shi, Ren Jing-ru, Wang Dian-chen (Inst. of High Energy Phys., Acad. Sinica, Peking, China).
Phys. Energ. Fortis & Phys. Nucl. (China), vol.7, no.1, p.118-20 (Jan. 1983). In Chinese.
The intensities of ultrahigh energy γ-rays observed in Chinese emulsion chamber experiments at several altitudes, including Yunnan Station (3200 m), Mt. Kambala (5500 m), and the foot of Mt. Qomolangma (Everest, 6500 m)

are summarized. An intensity-altitude relation and in particular, the attenuation length of γ-rays at the foot of Mt. Qomolangma are presented. (7 refs.)

Diffusion of low-energy electrons as a function of the position of outburst relative to the interplanetary current sheet ....See Entry 69454

Method of estimating Langmuir's turbulence in a solar flare ..See Entry 69509

94.40K Solar modulation and geophysical effects

69459 Solar cycle variations of cosmic ray intensity and large-scale structure of the heliosphere. S.P.Agrawal (Vikram Space Phys. Centre, APS Univ., REWA, India).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.127-35 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
This review summarizes some of the recent results obtained by ground-based detectors recording cosmic-ray intensity at high energies (>1 GeV) for almost five decades. The long-term changes observed in the isotropic and anisotropic components of cosmic-ray intensity are presented. It is noted in particular that significant changes occurred in the characteristics of cosmic-ray modulation after the 1969-70 period. Most of these are definitively related to the reversal of the solar poloidal field; their characteristics are described with a view to relate these with the heliospheric configuration. Anomalies in the variational characteristics of both isotropic and anisotropic parts of cosmic ray intensity, noticed particularly during the period of very high speed solar wind streams, are discussed in detail. Phenomena with periodicities of 11 and 22 years occur simultaneously; their relative importance is derived and related to interplanetary variables. Suggestions for further studies, as needed, are also incorporated. (35 refs.)

69460 Effect of neutrino-oscillations on the fluxes of atmospheric neutrinos. D.V.Dass (Indian Inst. of Technol., Bombay, India), K.V.L.Sarma.
Proceedings of the VI High Energy Physics Symposium (papers in summary form only received), Mysore, India, 6-11 Dec. 1982 (Bombay, India: Dept. Atomic Energy 1982), p.28
An analysis of the effects of neutrino oscillations on both the upward and downward fluxes of atmospheric neutrinos is given for different ranges of the oscillation parameters. Some simple relations for the oscillation-modified fluxes of $(\nu_e+\bar{\nu}_e)$ and $(\nu_\mu+\bar{\nu}_\mu)$ in the atmosphere are given as useful future tests of the two-component model.

Neutrino backgrounds in the Kolar Gold Field nucleon decay experiment ....
..............................See Entry 65150

Cosmic ray modulations related to the interplanetary magnetic field intensity ...
..............................See Entry 69455

Variation of the intensity of ultrahigh energy γ-rays with altitude ....
..............................See Entry 69458

Possibility of studying cosmic rays with energies $>10^{20}$ eV ...See Entry 69463

94.40L Composition and energy spectra

69461 Cosmic-ray abundances of Sn, Te, Xe, and Ba nuclei measured on HEAO 3. W.R.Binns (Dept. of Phys., Washington Univ., St. Louis, MO, USA), R.K.Fickle, T.L.Garrard, M.H.Israel, J.Klarmann, K.E.Krombel, E.C.Stone, C.J.Waddington.
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L93-6 (15 April 1983).
Elements with even atomic number (Z) in the interval $50 \leq Z \leq 56$ have been resolved in the cosmic radiation using the Heavy Nuclei Experiment on the *HEAO* 3 satellite. The observation that $_{50}$Sn and $_{56}$Ba are more abundant than $_{52}$Te and $_{54}$Xe is inconsistent with a pure r-process cosmic-ray source. Adjustment of source abundances for an enhancement of those elements with a low first ionization potential does not change this conclusion. (12 refs.)

69462 Cosmic-ray muon spectrum derived from the transferred energy spectrum of bursts observed by the Mutron calorimeter. K.Mitsui, A.Okada, Y.Kawashima, T.Katamura, S.Matsuno, Y.Muraki, Y.Ohashi, T.Suda (Inst. for Cosmic Ray Res., Univ. of Tokyo, Tanashi, Japan), T.Takahashi, S.Higashi, S.Ozaki, I.Nakamura, Y.Kamiya, K.Kobayakawa, H.Shibata, Y.Minorikawas, S.Mikamo.
J. Phys. G (GB), vol.9, no.5, p.573-93 (May 1983).
Measurements of the energy transfer, E', of bursts produced in a calorimeter are calibrated by the two magnet spectrometers of Mutron. Using this calibrated calorimeter, the authors observed the energy spectrum of bursts produced in the calorimeter up to 10 TeV and derived the muon energy spectrum at sea level. The exponent of the differential pion production spectrum is 2.62 ± 0.10 and 2.75 ± 0.17 in the muon energy region from 200 GeV to 6 TeV and from 1 TeV to 6 TeV, respectively. The muon energy spectrum thus obtained is compared with the direct measurement of the muon spectrum by the Mutron magnet spectrometers. (65 refs.)

Electrically neutral quarks: production of fractionally charged hadrons ....
..............................See Entry 65122

Possibility of studying cosmic rays with energies $>10^{20}$ eV ...See Entry 69463

Method of estimating Langmuir's turbulence in a solar flare ..See Entry 69509

94.40N Extensive air showers

69463 Possibility of studying cosmic rays with energies $>10^{20}$ eV. G.A.Gusev, L.G.Dedenko, I.M.Zheleznykh, M.A.Markov (Inst. of Nuclear Res., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.268-71 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.216-19 (20 Sept. 1982). [received: April 1983]
It may be possible to detect extensive air showers at energies above 10^{20} eV on the basis of their radio emission, with the radio waves reflected and scattered from the ionosphere. Estimates show that it would be possible to move up to energies of 10^{22} eV in research on the spectrum of cosmic rays, with statistics on the order of one event per year in the absence of a 'relict cutoff' of the spectrum of cosmic protons or in the case of oblique extensive air showers produced by neutrinos. (6 refs.)

Cosmic-ray muon spectrum derived from the transferred energy spectrum of bursts observed by the Mutron calorimeter ....See Entry 69462

94.40R High-energy interactions

Formation and signature of quark matter in relativistic ion collisions: evidence from cosmic rays ....See Entry 65227

94.40T Muons and neutrinos

Neutrino backgrounds in the Kolar Gold Field nucleon decay experiment ....
..............................See Entry 65150

Effect of neutrino-oscillations on the fluxes of atmospheric neutrinos ....
..............................See Entry 69460

Cosmic-ray muon spectrum derived from the transferred energy spectrum of bursts observed by the Mutron calorimeter ....See Entry 69462

94.60 INTERPLANETARY SPACE

(see also 96.60 Solar physics)

69464 On the equation of state of solar wind ions derived from Helios measurements. E.Marsch (Center for Space Res., MIT, Cambridge, MA, USA), K.H.Muhlhauser, H.Rosenbauer, R.Schwenn.
J. Geophys. Res. (USA), vol.88, no.A4, p.2982-92 (1 April 1983).
Observations of solar wind ion velocity distributions made by the Helios spacecraft between 0.3 and 1 AU are used to study the radial evolution of the so-called adiabatic invariants, for example, the ion magnetic moments. Significant differences between the parameters of protons and α particles have been found in dependence on the wind velocity. On the average, adiabaticity is observed to be violated. This violation of adiabatic invariance is interpreted as evidence that protons are heated perpendicular in the field in fast streams and, with less statistical significance, that α particles are cooled more strongly than for adiabatic expansion parallel to the magnetic field. The contribution of the differential streaming energy to the total internal energy of the ions is briefly investigated. Also, average heliocentric radial profiles for the ion heat fluxes are presented, and the possible role of the ion heat flux in supplying thermal energy during the radial expansion of the wind is examined. (34 refs.)

69465 A statistical study of MHD discontinuities in the inner solar system: Helios 1 and 2. F.Mariani (Istituto di Fisica, Univ. di Roma, Rome, Italy).
Sol. Phys. (Netherlands), vol.83, no.2, p.349-65 (March 1983).
A statistical study is made of the magnetic field directional discontinuities observed in early 1976 onboard Helios 1 and 2. Strong day-to-day variations of occurrence rates are found on either tangential or rotational discontinuities. No large variation (if any) is found versus either heliocentric distance or heliographic latitude. This contradicts previous findings obtained by the same technique on Pioneer 8 data in 1968-69; however, reasons are given to expect different results, under different solar conditions. Evidence of crossing of flux tubes on the order of one/hour is presented. (17 refs.)

69466 Helium abundance variations in the solar wind. G.Borrini (Inst. for Plasma Res., Stanford Univ., Stanford, CA, USA), J.T.Gosling, S.J.Bame, W.C.Feldman.
Sol. Phys. (Netherlands), vol.83, no.2, p.367-78 (March 1983).
Helium abundance variations in the solar wind have been studied using data obtained with Los Alamos plasma instrumentation on IMP 6, 7, and 8 from 1971 through 1978. For the first time, average flow characteristics have been determined as a function of helium abundance A(He). Low and average values of A(He) are each preferentially identified with a different characteristic plasma 'state': interplanetary magnetic field polarity reversals and high speed streams, respectively. (67 refs.)

69467 Momentum flux invariance and solar wind sources. R.Steinitz (Dept. of Phys., Univ. of Ulm, Ulm, Germany).
Sol. Phys. (Netherlands), vol.83, no.2, p.379-84 (March 1983).
New solar wind data from Helios-2 are used to study, in a statistical fashion, the relation between proton number density n, flow speed u and heliocentric distance r. It is shown that the average of nu^2r^2 does not depend on flow speed nor on distance, verifying the previously established invariance of momentum flux density (mnu^2) carried by the solar wind. Averages of mnu^2 from different spacecraft do not show correlation with solar cycle. Rather, the close agreement (to within 1.8%) of values from Helios-1 and Helios-2 suggests that the momentum flux density carried by the solar wind may be also constant during the solar cycle. (14 refs.)

69468 Propagation of solar disturbances: theories and models. S.T.Wu (Univ. of Alabama, Huntsville, AL, USA).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.73-83 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Recent theoretical developments and the construction of several models for the propagation of solar disturbances from the Sun and their continuation throughout heliospheric space are discussed. Emphasis centers on physical mechanisms as well as mathematical techniques (i.e. analytical and numerical methods). This outline leads to a discussion of the present state-of-art of theoretically-based modeling efforts in this area. It is shown that the fundamental theory for the study of propagation of disturbances in heliospheric space is centered around the self-consistent analysis of wave and mass motion within the context of magnetohydrodynamics in which the small-scale structures will be modified by kinetic effects. Finally, brief mention is made of some interesting problems for which attention is needed for advancement of understanding the physics of large-scale propagation of solar disturbances in heliospheric space. (20 refs.)

69469 Direct correlations between coronal transients and interplanetary disturbances. R.Schwenn (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.85-99 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Major interplanetary shock waves have often been successfully associated with major solar flares. The interplanetary response to weaker solar events, e.g. eruptive prominences (EP) and slow coronal transients, is far less pronounced. Recently, progress has been made by combining the newly-available data of white-light-coronagraph measurements from the Earth-orbiting satellite P78/1, in-situ plasma measurements from the HELIOS solar probes positioned mostly above the Sun's limb at solar distances between 60 and 200 $R_\odot$ ground based Hα-coronagraphs. In the years 1979 to 1981 about 25 uniquely associated events were identified. The events can be sorted into three main categories: The 'flare-type': 13 events, probably all of them flare-related. The 'EP-type': 4 events, none of them flare-related, at least one was observed as an Hα-EP, transient speed from 200 to 410 km s^{-1}, all post-accelerated (indicating 'driven' injection), all followed by shocks with at least one magnetic cloud, one showing presence of He$^+$ and O^{2+} behind the shock. The 'NCDE-type': 2 events, one observed as an Hα-EP, the other without known solar source, $v_t = 130$ and 470 km s^{-1}, one post-accelerated, the other one not, considerable density increase in interplanetary plasma (however, in pressure equilibrium with surroundings), one event including shock, the other not. (27 refs.)

69470 Observations of interplanetary shocks: recent progress. E.J.Smith (Jet Propulsion Lab., Pasadena, CA, USA).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.101-10 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Interplanetary shock observations since 1978 are reviewed. Since the interval coincides with the recent solar maximum, emphasis is placed on shocks associated with transient solar phenomena, including coronal transients and eruptive prominences as well as flares. A good correlation between shocks and Storm Sudden Commencements has persisted into the recent maximum. Shocks have been identified that are associated with disappearing filaments and coronal transients rather than with flares. Significant progress has been made in the indirect observation of shocks near the Sun as a result of radio wave measurements in interplanetary space and measurement of the scintillation and spectral broadening of spacecraft radio transmissions. Preliminary results regarding the thickness of interplanetary shocks have appeared. Several quasi-parallel shocks propagating more nearly along, rather than across, the magnetic field have been identified. The plasma drivers accompanying interplanetary shocks magnetic field have been identified. The plasmas drivers have received increased attention and distinctive features have been found in electron, ion and magnetic field data. (28 refs.)

69471 Ion acceleration at shocks in interplanetary space: a brief review of recent observations. J.T.Gosling (Los Alamos Nat. Lab., Univ. of California, Los Alamos, NM, USA).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.113-26 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The mechanism by which ions are accelerated near the Earth's bow shock and near shocks propagating outward from the Sun in response to solar activity appears to be essentially the same. For both types of shock the solar wind thermal distribution acts as a seed population. Leaked magnetospheric ions and resident flare ions are additional seed populations for the bow shock and outward propagating shocks respectively. The acceleration of solar wind ions at these shocks begins with either the reflection of ions off the shock or leakage of shocked plasma back through the shock. Interaction with a disruption wave field self-generated by these backstreaming ions is reponsible for the remainder of the acceleration at the bow shock. Both the disruption wave field and the ambient interplanetary wave field play important roles in accelerating ions at outward propagating shocks, but on different time scales. The geometry of the shock and the duration of field line connection to the shock play decisive roles in determining what is observed. (31 refs.)

69472 Solar-wind disturbances and the solar wind-magnetosphere energy coupling function. S.-I.Akasofu (Geophys. Inst., Univ. of Alaska, Fairbanks, AK, USA).
Space Sci. Rev. (Netherlands), vol.34, no.2, p.173-83 (Feb. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Recent studies of the solar wind-magnetosphere interaction are reviewed in terms of the input-output relationship. It is shown that the magnetosphere is primarly a directly driven system and that the interaction constitutes a dynamo. As another important problem of the interaction, the chain of processes is examined by which the dynamo-generated power is transmitted to the polar ionosphere, leading to various auroral phenomena. Possible implications of these magnetospheric findings for solar flare studies are discussed. It emerges from this analysis that in solar-terrestrial physics the solar activity-magnetospheric disturbance relationship should be considered as a single sequence of process involving four dynamos: (1) the solar wind generation dynamo, (2) the sunspot dynamo, (3) the solar wind-magnetosphere dynamo, and (4) the auroral dynamo. As one of the basic problems in solar-terrestrial physics, the importance of a study of causes of the north-south component of the solar wind magnetic field and of its time variations is emphasized as a missing link between solar activity and magnetospheric disturbances. (29 refs.)

Fifth International Symposium on Solar-Terrestrial Physics ....See Entry 64584
Upstream waves and particles ....See Entry 69445
IMF control of the Earth's magnetosphere ....See Entry 69446
Plasma processes within the magnetosphere boundaries ....See Entry 69448
Solar cycle variations of cosmic ray intensity and large-scale structure of the heliosphere ....See Entry 69459
Global characteristics of magnetic flux ropes in the Venus ionosphere ....See Entry 69527
Electrodynamics of submicron dust in the cometary coma ....See Entry 69550
Coronal disturbances and their terrestrial effects ....See Entry 69587
Solar wind theory ....See Entry 69591

94.80 AEROSPACE FACILITIES AND TECHNIQUES; SPACE RESEARCH

(see also 87.65 Aerospace biophysics and medical physics)

69473 Satellite orbit perturbations due to the deforming potential of centrifugal forces. M.Bursa (Astron. Inst., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.74-9 (March 1983).
The additional potential in outer space, generated by the deformation of Earth masses due to the variations in the direction of the vector of the Earth's rotation relative to the axes of the Earth's ellipsoid of inertia, is derived. The influence of this potential on the satellite orbit dynamics is studied. (6 refs.)

69474 Spatial and radiometric resolution of the Landsat-3 RBV system. P.Dosiere, C.Justice (ESA/EPO, Frascati, Italy).
Int. J. Remote Sens. (GB), vol.4, no.2, p.447-55 (April-June 1983).
Major constraints on the RBV (Return Beam Vidicon) system spatial and radiometric resolution are the optical limitations of the camera lens, the sensitivity of the vidicon, the system noise and the video sampling rate. The Landsat-3 RBV lens resolution limit is 21.45 m ground equivalent half-cycle. The Earthnet video sampling rate at 7.5 megasamples, gives an across track ground pixel size of 18 m. The along track pixel size is controlled by the number of scan lines in one frame, which gives a ground equivalent pixel size of 24 m. The MTF curve calculated from the RCA manual shows an EIFOV of 45.5 m. At 21.45 m ground equivalent half-cycle, the modulation transfer factor is 5.4 per cent which with a dynamic range of 64 quantising levels gives a two- or three-level contrast between black and white linear ground targets. In the panchromatic waveband with a white level saturation at 2.013 mW/cm^2-sr, most ground cover types will occur within the first 50 per cent of the dynamic range. Given the Earthnet quantisation step size to r.m.s. noise ratio of 0.51, there is a 56 per cent probability of assigning a level to within ±1 value of its correct level. This is assuming a Gaussian distribution for the system noise. The noise is equivalent to the MTF sensitivity of the system at the lens resolution limit. (12 refs.)

69475 Maximizing the entry corridor and minimizing energy expenditures during insertion of a spacecraft into the orbit of an artificial satellite of Jupiter by a composite method. N.M.Ivanov, A.I.Martynov, N.L.Sokolov.
Cosmic Res. (USA), vol.20, no.4, p.372-83 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.529-41 (July-Aug. 1982). [received: April 1983]
Questions of control during the insertion of a glider-type spacecraft into the orbit of an artificial satellite of Jupiter with preliminary aerodynamic braking in the atmosphere and with the use of additional atmospheric correction of the spacecraft's motion are investigated. Solutions of the variational problems of seeking the maximum of the entry corridor width and the minimum of the required energy expenditures in the formation of the orbit are obtained. Some quasioptimal control programs are examined for the atmospheric segment of the motion. Numerical and graphical material is shown. (5 refs.)

69476 The last 14 days of Skylab 1: orbit determination and analysis. D.M.C.Walker (Royal Aircraft Establ., Farnborough, England).
Proc. R. Soc. London Ser. A (GB), vol.387, no.1792, p.187-217 (8 May 1983).
The orbit of Skylab 1 (1973-27 A) has been determined from some 1400 observations during the 14 days before decay on 1979 July 11. There are 14 daily orbits with standard deviations corresponding to average accuracies of 40 mm cross track and 30 m radial. A 15th orbit, only slightly less accurate, was determined from observations on July 11 between the manoeuvre at 07.45 UT and decay at 16.37 UT. The variations in inclination due to atmospheric rotation and 16th-order resonance with the geopotential have been successfully analysed, to give the first values of 16th-order geopotential coefficients determined from resonance, and a value for the atmospheric rotation rate at a height of 210-220 km. The daily changes in semi-major axis have been used to determine 13 daily values of air density, at heights from 252 km down to 179 km. The variations of eccentricity and argument of perigee take unusual forms, but detailed analysis shows that the variations are in full accord with the theory for an atmosphere with day-to-night variation in density, with the perigee progressing towards the point of minimum density. (27 refs.)

69477 Spacecraft charging effects. R.Grard, K.Knott, A.Pedersen (Space Sci. Dept., ESA, ESTEC, Noordwijk, Netherlands).
Space Sci. Rev. (Netherlands), vol.34, no.3, p.289-304 (March 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
This paper gives an overview of electrostatic charging which occurs on spacecraft in different plasma environments. Particular emphasis is given to differential charging between sunlit and shadowed insulated surfaces, a phenomenon which is often observed in the geostationary orbit. It can generate potential differences of several kilovolts between adjacent surfaces. This can lead to discharges and serious spacecraft anomalies such as spurious telecommands caused by voltage and current transients on cable harnesses. Experience with the GEOS and ISEE satellites has demonstrated that differential charging can be avoided by making outer surface elements conductive and connecting them to a common ground. (20 refs.)

Attitude stability of torque-free axisymmetric dual spinners with energy sinks, considering spin change allotment between rotor and platform ....See Entry 66452
Some scientific objectives of a satellite-borne lightning mapper ....See Entry 69335
Optimal control in orbital rendezvous ....See Entry 69479
New infra-red telescope [IRAS] ....See Entry 69498
Atomic oxygen emissions observed from Pioneer Venus ....See Entry 69523
The surface of Mars: a post-Viking view ....See Entry 69530

94.90 OTHER TOPICS IN SPACE PHYSICS

Fifth International Symposium on Solar-Terrestrial Physics ....See Entry 64584

95.00 FUNDAMENTAL ASTRONOMY AND ASTROPHYSICS, INSTRUMENTATION AND TECHNIQUES AND ASTRONOMICAL OBSERVATIONS

95.10 FUNDAMENTAL ASTRONOMY

Positions of minor planets ....See Entry 69533
Astrometry and photometry of comet P/Halley in October and November 1982 ....See Entry 69548
P/Halley: first signs of activity? ....See Entry 69549
New Comet IRAS-Araki-Alcock 1983d ....See Entry 69551
Periodic Comet Tempel 2 (1982d) ....See Entry 69552
Comet IRAS-Araki-Alcock (1983d) ....See Entry 69553
Comet IRAS-Araki-Alcock (1983d) ....See Entry 69554
Comet IRAS-Araki-Alcock (1983d) ....See Entry 69556
Comet IRAS-Araki-Alcock (1983d) ....See Entry 69557
Comet Sugano-Saigusa-Fujikawa (1983e) ....See Entry 69558
PSR 1937+214 ....See Entry 69637
Positions of the SiO masers in Orion-KI: anisotropy on a scale of 70 AU ....See Entry 69696
Optical positions of quasars ....See Entry 69749

95.10C Celestial mechanics

(for dynamics and kinematics of stellar systems, see 98.10)

69478 Problem of three rigid bodies. Conversion of the Hamiltonian to Delaunay and Andoyer variables. M.Sidlichovsky (Astron. Inst., Czechoslovak Acad. of Sci., Praha, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.65-74 (March 1983).
The problem of three rigid bodies is formulated in Andoyer and Delaunay variables. The Delaunay variables are based on Jacobi coordinates. Knowledge of the density distribution inside the bodies is not required and only their Stokes constants must be known. The Hamiltonian of the problem is presented without truncation. Starting with this Hamiltonian averaged over the fast variables, applies various restrictive assumptions and obtain different approximations of the problem. (13 refs.)

69479 Optimal control in orbital rendezvous. Yu.P.Yablon'ko.
Cosmic Res. (USA), vol.20, no.4, p.347-52 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.499-504 (July-Aug. 1982). [received: April 1983]
The rendezvous of two space vehicles moving in close orbits its investigated. (5 refs.)

Satellite orbit perturbations due to the deforming potential of centrifugal forces ....See Entry 69473

The last 14 days of Skylab 1: orbit determination and analysis ....See Entry 69476

Evolution of cometary perihelion distances in Oort cloud: another statistical approach ....See Entry 69517

The variations of eccentricity and apse precession rate of a narrow ring perturbed by a close satellite ....See Entry 69519

Orbital evolution of the Galilean satellites: capture into resonance ....See Entry 69536

Orbits of Saturn's F ring and its shepherding satellites .... See Entry 69544

Dependence of the observed rate of meteors on the zenith distance of the radiant ....See Entry 69561

95.30 FUNDAMENTAL ASPECTS OF ASTROPHYSICS

69480 The statistics of gravitational lenses: apparent changes in the luminosity function of distant sources due to passage of light through a single galaxy. M.Vietri, J.P.Ostriker (Princeton Univ. Obs., Princeton, NJ, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.488-510 (15 April 1983).
Considers how the apparent distribution of fluxes (*N-F* relation) of point sources seen behind an intervening galaxy will change due to gravitational lensing of the galaxy as a whole or due to mini-lenses within it. The analysis is exact in the limit that the optical depth to lensing is small. There should be a significant increase in the apparent density of quasars seen near galaxies but that a sample of more than $10^{4.5}$ galaxies will have to be studied before a statistically significant result is found. (19 refs.)

69481 Dissipation of MHD waves in an inhomogeneous streaming plasma. R.Singh, K.M.Srivastava (Dept. of Math., Univ. of Roorkee, Roorkee, India).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.3-18 (Feb. 1983).
The investigation of instabilities adopting the point of view of inhomogeneous mass flow, physically corresponds to consideration of stability of the perturbations whose wavelengths in the direction of plasma inhomogeneities are much larger than the characteristics plasma scale length. The dissipation of hydromagnetic-waves and instabilities takes place due to the inhomogeneous plasma flow. Both the velocity and plasma density vary in the direction perpendicular to the magnetic field. It is found that the Alfven wave branch and magnetosonic branch may be driven unstable by the velocity shear. Instability, oscillatory modes, marginal instability and overstability are worked out. (11 refs.)

69482 Nonlinear Rayleigh-Taylor instability. S.K.Malik, M.Singh (Dept. of Math., Simon Fraser Univ., Burnaby, BC, Canada).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.45-50 (Feb. 1983).
The Rayleigh-Taylor instability in hydromagnetics is investigated with the use of the method of multiple scales. It is shown that when the wavenumber K is equal to the critical wavenumbers K_c, the amplitude modulation of a standing wave can be described by the nonlinear Schrodinger equation from which the nonlinear cutoff wavenumber is subsequently derived. (11 refs.)

69483 On disk accretion. V.A.Urpin (A.F. Ioffe Phys. & Tech. Inst., Acad. of Sci., Leningrad, USSR).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.79-107 (Feb. 1983).
A simple but sufficiently accurate method for calculating an accretion disk structure is developed. The detailed analysis of the accretion disk is fulfilled by using this method. The effect of turbulent heat transfer on the disk structure is taken into account along with the effect of radiative transfer. The turbulent heat transfer is shown to play an important role, and may be even predominant in the inner disk region. The dependence of temperature T and density ρ on the z-coordinate is found. Simple analytic expressions are proposed for the run of the density in all the disk zones. It is shown that the inner disk region is convectively stable. The main parameters of all the zones are derived. The geometry of regular motions is studied; the regular hydrodynamical flows are found to appear directed both toward and outside the central object. A detailed comparison is made with the results of other authors. (41 refs.)

69484 Polytropic spheres with isothermal cores. K.Pandey, A.K.Pande, M.C.Durgapal (Dept. of Phys., Kumaun Univ., Nainital, India).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.139-45 (Feb. 1983).
The paper deals with massive fluid spheres with an isothermal core (having finite central density) and a polytropic envelope in terms of general relativity. The matching of the solutions in the core and envelope has been done using Bondi's condition, $H=0$ and also without it. The study reveals that since this condition does not correspond to any particular physical situation the maximum values of fractional core size, fractional core mass and the redshift do not occur at $H=0$, but that they occur at some other point. Within the permissible physical conditions ($\mathrm{d}P/\mathrm{d}\rho \leq 1$) the maximum values of M_{core}/M, R_{core}/R and the surface redshift, for an isothermal core $P=\rho/3$, are respectively 0.473, 0.554 and 0.565. Using the condition $H=0$, it has been shown that for isothermal cores corresponding to the equation of the state $P \geq 0.6\rho$, the configurations are pulsationally unstable. (13 refs.)

69485 A self-similar flow of self-gravitating gas behind a shock wave with radiation heat flux. I. J.B.Singh, P.R.Vishwakarma (Dept. of Math., SGR Postgraduate Coll., Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.153-9 (Feb. 1983).
Self-similar flows of self-gravitating gas behind the spherical shock wave propagating in a non-uniform atmosphere at rest, taking radiation heat flux into consideration, are investigated. The total energy of the wave is non-constant and can be made to vary slowly with time. (6 refs.)

69486 A self-similar flow in generalised Roche model with radiation heat flux. II. J.B.Singh, P.R.Vishwakarma (Dept. of Math., SGR Postgraduate Coll., Jaunpur, India).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.161-9 (Feb. 1983).
For pt.1, entitled 'A self-similar flow in generalised Roche model with increasing energy', see ibid., vol.88, no.2, p.269 (1982). Self-similar flows of a gas moving under the gravitational attraction of a central body of fixed mass behind a spherical shock wave and propagating in a non-uniform atmosphere at rest, taking radiation heat flux into consideration, are investigated. The total energy of the wave between the shock front and inner expanding surface is taken to be time-dependent. (8 refs.)

69487 Gravitational lenses. J.R.Gott,III (Dept. of Astrophys. Sci., Princeton Univ., Princeton, NJ, USA).
Am. Sci. (USA), vol.71, no.2, p.150-7 (March-April 1983).
Cosmic mirages produced by gravitational bending of light may solve some of the most pressing problems in cosmology today. (30 refs.)

69488 Quasi-axisymmetric circulation and superrotation in planetary atmospheres. H.G.Mayr, I.Harris (Lab. for Planetary Atmospheres, Goddard Space Flight Centre, Greenbelt, MD, USA).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.124-36 (May 1983).
Using a spectral model the authors discuss a quasi-axisymmetric circulation in an anisotropic viscous fluid. It is understood that the required large eddy diffusivities may arise from longitudinal disturbances and therefore, basically, the flow is not completely axisymmetric. Solar radiation absorbed at low latitudes drives large scale motions, with air rising near the equator and falling at higher latitudes. Near the equator in particular, where the Coriolis force vanishes, the momentum balance is established between horizontal and vertical eddy diffusion. Applications to Venus, Jupiter and Saturn are discussed. (45 refs.)

69489 Laboratory measurement of the 4_{04}-3_{13} 70 GHz transition ground-state methylene (CH_2). F.J.Lovas, R.D.Suenram (Molecular Spectroscopy Div., NBS, Washington, DC, USA), K.M.Evenson.
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L131-3 (15 April 1983).
Measurement of the $N_{\mathrm{KK}}=4_{04}$-3_{13} rotational transition of X^3B_1 CH_2 is reported. The rotational transition is split into three fine-structure components due to electron spin and spin-rotation interactions. These were observed at 68.37 GHz, 69.01 GHz, and 70.68 GHz, each line within 20 MHz of the values predicted from a prior analysis of the far-infrared rotational spectrum. Also, the triplet hyperfine structure due to the proton nuclear spin was well resolved. (9 refs.)

69490 Dyon black hole and its mass formula in the Tomimatsu-Sato-Yamazaki space-time. M.Kasuya (Inst. for Nuclear Study, Univ. of Tokyo, Tokyo, Japan).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.347-50 (April 1983).
It is shown that a dyon solution, characterized by five parameters (mass M, angular momentum J, electric change Q, magnetic charge Φ, and distortion parameter δ), has an event horizon for arbitrary odd integer δ and satisfies the Christodoulou-Ruffini mass formula. (5 refs.)

69491 Relativistic paramagnetism. W.T.Grandy,Jr. (Dept. of Phys. & Astron., Univ. of Wyoming, Laramie, WY, USA).
J. Phys. A (GB), vol.16, no.6, p.1207-14 (21 April 1983).
The equation of state is obtained for a degenerate system of non-interacting, relativistic, neutral fermions with spin $^1/_2$ in a uniform magnetic field. The question of arbitrarily large fields is addressed, and previous results for the ground state are extended to finite temperatures. (13 refs.)

69492 The synthetic method in radiative transfer theory. D.J.Bond (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England).
J. Phys. A (GB), vol.16, no.7, p.L239-42 (11 May 1983).
The utility of the synthetic method for performing non-LTE line radiation transfer calculations is investigated. The stability and convergence of the method are determined for an idealised problem. This analysis is compared to numerical calculations. Regimes where the method is likely to be useful are identified. (6 refs.)

69493 The pure rotation spectrum of the hydroxyl radical and the solar oxygen abundance. A.Goldman, D.G.Murcray (Dept. of Phys., Univ. of Denver, Denver, CO, USA), D.L.Lambert, J.F.Dominy.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.767-76 (May 1983).
Observations of pure rotation $^2\Pi$ (0-0) lines of the hydroxyl radical in the solar photospheric spectrum provide a new and independent determination of the solar oxygen abundance. These OH lines with the Holweger-Muller model atmosphere give $\log \epsilon(0)=8.84$ which is within 0.08 dex of the abundance provided by the [0 I] lines and the same model. It is pointed out that a detection of the CH pure rotation lines would permit a determination of the O/C abundance ratio with a much reduced sensitivity to the model atmosphere uncertainties. Selected combinations of atomic and molecular (not including the OH pure rotation lines) lines give $\log \epsilon(0)/\epsilon(C)=0.23 \pm 0.03$ dex. (29 refs.)

69494 Line ratios for O VII. J.G.Doyle, S.S.Tayal (Armagh Obs., Armagh, N Ireland), A.E.Kingston.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.31p-4 (May 1983).
New theoretical rates for electron excitation of the transitions 1^1S-2^3P and 1^1S-2^3P in O VII are used to calculate the line ratios R_0 (forbidden line to intercombination line) and G_0 (forbidden plus intercombination lines to resonance line). The theoretical values of R_0 are slightly larger than earlier calculations but the values of G_0 are significantly lower than the earlier calculations. With the results the value of $G_0 \doteq 1.0$, from the solar observations of McKenzie and Landecker (1982), would predict an electron temperature of 2.0×10^6K, which is in good agreement with the temperature of 1.8×10^6K predicted by recombination-ionization equilibrium calculations. (17 refs.)

69495 Monopole heat. M.S.Turner (Astron. & Astrophys. Center, Univ. of Chicago, Chicago, IL, USA).
Nature (GB), vol.302, no.5911, p.804-6 (28 April 1983).
The most stringent astrophysical limit on the flux of superheavy magnetic monopoles is based on the energy released when monopoles captured by a neutron star catalyse nucleon decay within the neutron star, and is: $F_G \lesssim 10^{-22}$ cm^{-2} sr^{-1} s^{-1}. This, and other astrophysical bounds, are bounds on the average flux of monopoles in the Galaxy, not on the local flux of monopoles. Monopoles moving more slowly than about $3 \times 10^{-5}c$ (10^{16} GeV m^{-1}) are stopped in the Earth. Inside the Earth they catalyse nucleon decay, resulting in the release of heat. A bound on the local flux of monopoles moving more

slowly than $3\times10^{-5}c$ (10^{16}GeV m^{-1}), $F_{\otimes}\lesssim10^{-21}$ cm^{-2} sr^{-1} s^{-1}, is derived by requiring the energy released to be less than the measured heat flow at the surface of the Earth. Similar arguments are used to derive a bound on the flux of monopoles at Jupiter moving more slowly than $10^{-3}c$ (10^{16} GeV m^{-1}), $F_3\lesssim10^{-18}$ cm^{-2} sr^{-1} s^{-1}. (21 refs.)

69496 Limitation imposed by strong Langmuir turbulence on the shelf-consistency of the quasi-linear dynamics. R.J.-M.Grognard (Div. of Radiophys., CSIRO, Sydney, Australia).
Sol. Phys. (Netherlands), vol.83, no.2, p.207-15 (March 1983).
Strong turbulence occurs when Langmuir waves reach Zakharov's (1972) threshold for the formation and collapse of plasma wave solitons. A more precise criterion, derived by Goldman et al. (1980) in the case of broadband Langmuir noise, is used to derive a necessary condition of self-consistency for models of the quasi-linear dynamics. The results suggest that a regime in which quasi-linear relaxation is important but strong turbulence is not may be relevant to type III solar radio bursts. (12 refs.)

Black holes and the stability of gravitation .... See Entry 64766

Novikov-type coordinates for HJ separable metrics .... See Entry 64767

Scalar-tensor theory of gravitation: generalizations and experimental limitations .... See Entry 64771

Classical and quantum models of strong cosmic censorship .... See Entry 64774

An inequality relating mass and electric charge in general relativity .... See Entry 64780

Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2) .... See Entry 64783

General static plane-symmetric solutions of the Einstein-Maxwell equations .... See Entry 64798

Positive mass theorems for black holes .... See Entry 64801

Producion of tachyons from Schwarzschild black holes .... See Entry 64803

Is there a quantum equivalence principle? .... See Entry 64806

Vector mesons in Friedman space-time .... See Entry 64810

Gravitational anisotropies of gyromagnetic ratios and tests of general relativity .... See Entry 64815

Test of the principle of equivalence by a null gravitational red-shift experiment .... See Entry 64816

Fermion-induced monopole-antimonopole annihilation .... See Entry 65080

Electrically neutral quarks: production of fractionally charged hadrons .... See Entry 65122

S II and S III branching ratios in the 600- to 1200-Å interval .... See Entry 65915

The nuclear hyperfine structure of deuterated ammonia .... See Entry 65964

MHD free-convection flow in the Stokes problem for a porous vertical plate by finite difference method .... See Entry 66634

Cosmic-ray abundances of Sn, Te, Xe, and Ba nuclei measured on HEAO 3 .... See Entry 69461

A statistical study of MHD discontinuities in the inner solar system: Helios 1 and 2 .... See Entry 69465

Atomic oxygen emissions observed from Pioneer Venus .... See Entry 69523

The clouds of Venus: sulfuric acid by the lead chamber process .... See Entry 69525

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Massive, degenerate neutrinos and cosmology .... See Entry 69771

Stability and structure of Newtonian gravitars .... See Entry 69772

95.55 ASTRONOMICAL INSTRUMENTS

69497 Radio-astronomy antennas for 3K cosmic radiation measurements. P.Bielli, E.Pagana (CSELT, Torino, Italy), G.Sironi.
CSELT Rapp. Tec. (Italy), vol.11, no.2, p.79-83 (April 1983).
The '3K Blackbody' study requires antennas quite different from those currently used for standard radioastronomical observations, because of the peculiar nature of Background Radiation. A first requirement is a main beamwidth 10-15 degree HPBW (Half Power Beam Width). Then extremely low sidelobes and backlobes and very good matching at the input of the antenna are necessary in order to minimize the antenna noise contribution. First investigation showed the possibility of improving the radiation performance of a horn reflector antenna by corrugating the feeding conical waveguide. The final solution consists in a corrugated conical horn which presents excellent radiative characteristics as a middle gain and low noise antenna. (4 refs.)

69498 New infra-red telescope [IRAS]. R.A.J.Arthur.
Indian & East. Eng., vol.124, no.10, p.439-40 (Oct. 1982). [received: March 1983]
A dream of infra-red astronomy for many years is close to realisation with the three-nation Infra-Red Astronomical Satellite. The author describes the new telescope. (no refs.)

69499 One-dimensional telescope aperture for brightness and velocity speckle interferometry measurements. C.Aime, J.Demarcq, F.Martin, G.Ricort (Dept. d'Astrophys., Univ. de Nice, Nice, France).
Opt. Eng. (USA), vol.22, no.2, p.224-6 (March-April 1983).
The use of a telescope with a 'one-dimensional' aperture (10×800 cm, for example) is suggested for high angular speckle interferometry. In the image plane, the speckles are elongated in a direction perpendicular to the entrance pupil. For a given amount of atmospheric turbulence, a one-dimensional pupil gives a contrast gain in the high frequencies region compared to the circular objective having the same resolution limit. Associated with a spectroscope a one-dimensional telescope allows the representation of the spatial-spectral plane with no loss of photons. This is obtained because the image of the telescope aperture is the entrance slit of the spectroscope. It permits precise, high resolution astronomical measurements as a function of wavelength, as well as velocity speckle interferometry at a high level of photons with CORAVEL-type experiments. The study of a domeless, altazimuthal mount, low cost prototype of 4 cm×80 cm, intended for solar observations is currently underway at the Nice Observatory. (13 refs.)

Testing the quality of the operating surface of a parabolic devitrified glass astronomical mirror .... See Entry 66366

Universal measuring tube for testing telescope systems .... See Entry 66368

Spatial and radiometric resolution of the Landsat-3 RBV system .... See Entry 69474

The near infrared spectrophotometer for the 182 cm Asiago telescope .... See Entry 69500

A holographic surface measurement of the Texas 4.9-m antenna at 86 GHz [space applications] .... See Entry 69507

Method for automatic compensation of geometrical distortions in astronomical television equipment .... See Entry 69510

Absentee Astronomy .... See Entry 69511

First results from the Clark Lake Multifrequency Radioheliograph [coronal images] .... See Entry 69586

95.65 AUXILIARY AND RECORDING INSTRUMENTS

69500 The near infrared spectrophotometer for the 182 cm Asiago telescope. D.Lorenzetti, R.Orfei, P.Saraceno (Istituto di Fisica, Spazio Interplanetario, Frascati, Italy), F.Strafella, C.B.Cosmovici.
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.171-8 (Feb. 1983).
A new near infrared spectrophotometer has been built for the Asiago 182 cm telescope. The instrument performs both broad band JHKLM photometry and 1-5 μ spectrophotometry; a tracking system on a field star allows closed loop mapping. The design and performance are discussed. (4 refs.)

69501 Star transits with a photoelectric micrometer applied to the transit instrument of Torino Observatory. E.Anderlucci, G.Chiumiento, M.G.Fracastoro, R.Iervolino (Osservatorio Astron. di Torino, Torino, Italy).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.142-5 (May 1983).
A photoelectric micrometer with a multislit grid and a photon counting device has been applied to the reversible transit instrument of Torino Observatory since January 1980. It allows the automatic determination of transit time of stars up to 8.0 visual magnitude. From the analysis of about 1300 observations of FK4 stars the mean square error of the mean transit time for one observation (reduced to the equator) proved to be $\epsilon_i=\pm0.0046$ s. The external mean error deduced from 80 group observations from January to October 1981 taking into account the residuals between $UT1(OAT)$ and $UT1(BIH)$ is $\epsilon_e=\pm0.0104$ s$=\pm0.156''$. The description of the photoelectric micrometer and the method for deriving the transit time from the photometric data are

also given. The photoelectric micrometer is now currently employed for regular observations for the determination of Universal Time with respect to the uniform time scale (*UTC*) in order to contribute to the studies of Earth's rotation. (8 refs.)

69502 High efficiency spectrographs for the EUV and soft X-rays. W.Cash (Lab. for Atmospheric & Space Phys., Univ. of Colorado, Boulder, CO, USA).
IEEE Trans. Nucl. Sci. (USA), vol.ns-30, no.2, p.1535-8 (April 1983). (1982 IEEE Conference on the Application of Accelerators in Research and Industry, Denton, TX, USA, 8-10 Nov. 1982).
A basic need of modern UV and X-ray astronomy is the capability to perform high resolution spectroscopy of faint stars. The use of modern grazing incidence optics can be coupled to high blaze angle reflection gratings used in the conical diffraction mount to offer a versatile, efficient approach to the design problem. The author discusses two designs of interest: an echelle spectrograph for use longward of 100 Å, and an objective reflection grating spectrograph for use in the soft X-rays. General design considerations and measurements of grating efficiencies are also presented. (7 refs.)

69503 The Berkeley parasitic SETI program. S.Bowyer, G.Zeitlin, J.Tarter, M.Lampton, W.J.Welch (Space Sci. Lab., Univ. of California, Berkeley, CA, USA).
Icarus (USA), vol.53, no.1, p.147-55 (Jan. 1983).
Parasitic programs for the Search for Extraterrestrial Intelligence (SETI), carried out concurrently with conventional radio astronomical observing programs, can be an attractive and cost-effective means of exploring the large multidimensional search space intrinsic to this effort. The authors describe a microprocessor-based automated SETI acquisition system which searches for and records spectra of narrowband signals in the IF band of an observatory receiver. Data taken with this system over 35 days at the Hat Creek Radio Observatory at 1612 MHz are discussed. Out of approximately 10^5 spectra processed during this period, 4000 were identified by the system as containing narrowband signals and were recorded. Subsequent analysis indicates that over 3900 of these are due to local RF contamination. The remainder are undergoing further investigation. (6 refs.)

69504 The design of polarimeters for astronomy. L.J.Cox (Hatfield Polytech. Obs., Hertford, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.571-9 (May 1983).
The concept of information capacity is used to compare the performance of different designs of astronomical polarimeter, as an aid in selecting the design which is most suited to a particular application. The example chosen to illustrate the method is the comparison of visible-region stellar polarimeters, but the method is of general applicability and the constraints applying to infrared polarimeters are also discussed. (41 refs.)

69505 Space and time resolved soft X-ray spectra using X-ray transmission gratings. N.M.Ceglio, A.M.Hawryluk, R.H.Price (Lawrence Livermore Nat. Lab., Livermore, CA, USA).
Opt. Eng. (USA), vol.22, no.2, p.241-6 (March-April 1983).
Gold transmission gratings with 0.3 μm spatial period, 0.6 μm thick have been fabricated and are being used for the spectroscopy of high temperature, laser-produced plasmas. A transmission grating has been coupled with a soft X-ray streak camera producing the first time resolved (20 psec resolution) continuous X-ray spectrum over the range 0.1 to 1.5 keV from a laser-produced plasma. In addition, a transmission grating has been coupled with a high resolution, Wolter-design X-ray microscope to produce an imaging spectrometer of unprecedented spatial and spectral resolution. In laboratory experiments the imaging spectrometer demonstrated a spectral resolving power $(\lambda/\Delta\lambda)$ of 200 and a spatial resolution of 1 μm. (9 refs.)

69506 Infrared camera for ten micrometer astronomy. J.F.Arens, G.M.Lamb, M.C.Peck (NASA/Goddard Space Flight Center, Greenbelt, MD, USA).
Opt. Eng. (USA), vol.22, no.2, p.267-8 (March-April 1983).
Describes an infrared imaging photometer employing a monolithic 32×32 pixel bismuth doped silicon charge injection device array. The device is primarily useful in the 8 to 13 μm atmospheric window. The detector is sufficiently sensitive to provide good performance on ground-based telescopes and promises to be very good for low background space flight operation. (no refs.)

Composite thin-foil bandpass filter for EUV astronomy: titanium-antimony-titanium .... See Entry 66376

Method for automatic compensation of geometrical distortions in astronomical television equipment .... See Entry 69510

95.70 OTHER INSTRUMENTATION AND TECHNIQUES

(inc. clocks, frequency standards)

69507 A holographic surface measurement of the Texas 4.9-m antenna at 86 GHz [space applications]. C.E.Mayer, J.H.Davis, W.L.Peters,III, W.J.Vogel (Dept. of Electrical Engng., Univ. of Texas, Austin, TX, USA).
IEEE Trans. Instrum. & Meas. (USA), vol.IM-32, no.1, p.102-9 (1982). (CPEM 82 Digest. Conference on Precision Electromagnetic Measurements, Boulder, CO, USA, 28 June-1 July 1982).
An instrument has been built which allows the electromagnetic measurement of the surface accuracy of a large millimeter-wavelength antenna. The University of Texas 4.9-m radiotelescope has been measured with this technique at 86.1 GHz to an accuracy of 4 μm at the surface. The technique is an interferometric one which is fast, accurate, and able to measure the whole antenna surface at once. While the technique is illustrated by its use on a large antenna, it could be used in a near-field measurement of a smaller antenna. Several antenna surface maps are presented. A comparison of run-to-run repeatability was made. The technique itself was tested by deforming the antenna surface in a known way and subsequently detecting the deformation. (23 refs.)

95.75 TECHNIQUES OF OBSERVATION AND REDUCTION

69508 A computer program to reduce photometric data. C.Cunningham, M.Kaitting (Dance Hill Obs., Kitchener, Ontario, Canada).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.10-16 (1982).
A description is given of a computer program written in BASIC and designed to yield ΔV and ΔB magnitudes in the standard UBV system. The program also yields other relevant data, such as standard deviation, mean error, Julian Date, and air mass. (2 refs.)

69509 Method of estimating Langmuir's turbulence in a solar flare. M.Karlicky (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.100-2 (March 1983).
In principle, the theory of hard X-ray emission and microwave solar bursts enables one to determine the development of the 'mean' distribution function of hot or superthermal electrons during the impulse phase of a flare. On the basis of this development of the distribution function of electrons, the method described is used to determine the parameters of Langmuir's turbulence, assumed to exist in a solar flare. (11 refs.)

69510 Method for automatic compensation of geometrical distortions in astronomical television equipment. V.A.Kachmin, Yu.A.Seliverstov.
Sov. J. Opt. Technol. (USA), vol.49, no.8, p.478-80 (Aug. 1982). Translation of: *Opt.-Mekh. Prom.-st. (USSR)*, vol.49, no.8, p.9-11 (Aug. 1982). [received: April 1983]
A method and algorithm are described for the automatic compensation of geometrical distortions, which were developed with consideration given to the specific requirements caused by the unique features of automated astronomical television equipment. The accuracy of the compensation algorithm, formulated on the basis of approximation splines, is evaluated by means of a mathematical model of the geometrical distortions. (8 refs.)

69511 Absentee Astronomy. L.F.Robinson.
Sky & Telesc. (USA), vol.65, no.4, p.310-11 (April 1983).
Discusses the control of telescope operations over very large distances. The Edinburgh UKIRT Remote Observing Facility is discussed. (no refs.)

69512 Phase retrieval in astronomy. J.R.Fienup (Environmental Res. Inst. of Michigan, Ann Arbor, MI, USA).
Topical Meeting on Signal Recovery and Synthesis with Incomplete Information and Partial Constraints, Incline Village, NV, USA, 12-14 Jan. 1983 (Washington, DC, USA: Opt. Soc. America 1983), p.ThA8/1-5
Reviews a number of proposed methods for reconstructing 2-D objects from stellar interferometry data. Emphasis is placed on an iterative algorithm for reconstructing an object from its Fourier modulus, for which computer-simulation results are shown. (40 refs.)

One-dimensional telescope aperture for brightness and velocity speckle interferometry measurements .... See Entry 69499

The near infrared spectrophotometer for the 182 cm Asiago telescope .... See Entry 69500

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95.80 ASTRONOMICAL OBSERVATIONS (LISTED BY TECHNIQUES OF OBSERVATION)

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95.80G Far infrared (bolometric, photoconductive)

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An X-ray survey of nine Algol systems ... See Entry 69653
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95.80S Other (inc. gravitational radiation, magnetograms, etc)

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95.85 CATALOGUES, ATLASES ETC

69513 Two newly discovered S stars in a list of faint red objects. E.R.Craine, D.E.Turnshek, D.A.Turnsheck (Steward Obs., Univ. of Arizona, Tucson, AZ, USA), P.C.Boeshaar.
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.185-91 (March 1983).
Presents a list of 103 faint red stars in a 0.7-square-degree area located near NGC 6820/23 on the galactic plane in the constellation Vulpecula. The stars were selected from Near Infrared Photographic Sky Survey visual and near-infrared photographic pairs and were chosen for their visual faintness as well as their red colors. Since some of these stars may be intrinsically extremely red they are interesting targets for spectroscopic observation. The authors note that two of the stars in the list have already been determined to be faint, pure S stars. (9 refs.)

69514 Sky atlas 2000.0. W.Tirion.
Cambridge, England: Cambridge (1981), 28 pp. [0 521 24467 6]
Sky Atlas 2000.0 is the first comprehensive set of star charts for this new coordinate epoch. It has been carefully planned and executed with the active observer in mind. It contains some 43000 stars to visual magnitude 8.0 and about 2500 deep-sky objects. The deluxe edition, with deep-sky objects and the Milky Way shown in various colors according to the key atop each chart, follows the introduction of the unbounded black-and-white desk and field editions of this atlas; these have, respectively, black stars on a white background and white stars against a black background.

96.00 SOLAR SYSTEM

96.10 GENERAL, SOLAR NEBULA, AND COSMOGONY

69515 Models of the formation of the solar nebula. P.Cassen, A.Summers (Ames Res. Center, NASA, Moffett Field, CA, USA).
Icarus (USA), vol.53, no.1, p.26-40 (Jan. 1983).
Models of the collapse of a protostellar cloud and the formation of the solar nebula reveal that the size of the nebula produced will be the larger of $R_{CF} \equiv J^2/k^2GM^3$ and $R_V \equiv (GMv/2c_s{}^3)^{1/2}$ (where J, M, and c_s are the total angular momentum, total mass, and sound speed of the protostellar material; G is the gravitational constant; k is a number of order unity; and v is the effective viscosity in the nebula). From this result it can be deduced that low-mass nebulas are produced if $P \equiv (R_V/R_{CF})^2 \gg 1$; 'massive' nebulas result if $P \lesssim 1$. The value of J distinguishes most current models of the solar nebula, since $P \propto J^{-4}$. Analytic expressions for the surface density, nebular mass flux, and photospheric temperature distributions during the formation stage are presented for some simple models that illustrate the general properties of growing protostellar disks. (39 refs.)

69516 Some cosmochemical consequences of a turbulent protoplanetary cloud. G.E.Morfill (Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany).
Icarus (USA), vol.53, no.1, p.41-54 (Jan. 1983).
Physical processes affecting dust and vapor in a turbulent disk, which is hot in a small central region ($T > 1500$K) and cold at its outer edge ($T \sim 50$K) are discussed. Such disks are obtained from hydrodynamic collapse calculations of rotating gas clouds. While these calculations give the result that most of the disk, including the planetary region, remains cold ($\lesssim 400$K) throughout the evolution of the system, it can be shown, nevertheless, that the information of the hot interior is preserved in solids. Therefore it is suggested that the basic cosmochemical evidence from meteorite analysis, in favor of a hot protoplanetary cloud, can be understood. Detailed calculations involving estimates of sizes, both for inclusions and chondrules, as well as rim structures are given. (48 refs.)

69517 Evolution of cometary perihelion distances in Oort cloud: another statistical approach. B.Lago, A.Cazenave (Centre Nat. d'Etudes Spatiales, Toulouse, France).
Icarus (USA), vol.53, no.1, p.68-83 (Jan. 1983).
The evolution of the perihelion distance distribution in the Oort cloud was studied over the age of the Solar System, under the gravitational perturbations of random passing stars, using a statistical approach. These perturbations are accounted for through an empirical relation relating the change in cometary perihelion distance to the closest-approach comet-star distance; this relation is deduced from a previous study [Scholl, Cazenave, and Brahic, (1982)]. Two kinds of initial perihelion distances are considered: (a) perihelion distances <2500 AU, associated with an origin of comets as icy planetesimals in the region of the giant planets, and (b) larger perihelion distances (up to 5×10^4 AU), possibly representative of comet formation as satellite fragments in the accretion disk of the primitive solar nebula. Distant star-comet encounters, as well as rare close encounters, are considered. Several quantities are estimated. (16 refs.)

The $^{12}C/^{13}C$ ratio in Jupiter from the Voyager infrared investigation ....
....See Entry 69537

Isotopic anomalies: early history of the Solar System .... See Entry 69563

96.20 MOON

69518 Sulphur content and sulphur isotope composition of orange and black glasses in Apollo 17 drive tube 84002/1. T.P.Ding (Dept. of Geology & Chem., McMaster Univ., Hamilton, Ontario, Canada), H.G.Thode, C.E.Rees.
Geochim. & Cosmochim. Acta (GB), vol.47, no.3, p.491-6 (March 1983).
The sulphur contents and $\delta^{34}S$ values have been determined for the bulk and various grain size fractions of three 74002/1 lunar drive tube samples. The sulphur contents of the bulk samples are much lower than those of other lunar soils. These samples show an increase of sulphur concentration with decreasing particle size which is more marked than for other soils and indicates that the orange and black glass droplets have a coating enriched in sulphur and other volatile elements. In sharp contrast with other soils, the orange and black glasses have slight positive $\delta^{34}S$ values for large particles while the smallest particle sizes show negative $\delta^{34}S$ values. This indicates that the coating of the glassy droplets is enriched in isotropically light sulphur. These observations favour the theory that the orange and black glasses were generated by a volcanic fire fountain. (25 refs.)

96.30 PLANETS AND SATELLITES

(exc. the Moon; for celestial mechanics, see 95.10; for Earth as an astronomical body, see 91. Geophysics)

69519 The variations of eccentricity and apse precession rate of a narrow ring perturbed by a close satellite. N.Borderies, P.Goldreich (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA), S.Tremaine.
Icarus (USA), vol.53, no.1, p.84-9 (Jan. 1983).
Derives a Hamiltonian which describes the first-order perturbations of orbital eccentricity and apse precession rate of a narrow ring due to a close satellite whose orbit is also eccentric. The treatment covers cases in which the satellite crosses the ring. The level curves of the Hamiltonian are displayed for several values of the parameters. The authors apply results to the interaction of Saturn's F ring with its inner shepherd satellite. (6 refs.)

Upstream waves and particles ....See Entry 69445

Some cosmochemical consequences of a turbulent protoplanetary cloud ....
....See Entry 69516

96.30E Venus

69520 Atmosphere of Venus from optical measurements by Venera-11 and -12. Yu.M.Golovin, V.I.Moroz, B.E.Moshkin, N.F.San'ko, A.P.Ehkonomov.
Cosmic Res. (USA), vol.20, no.4, p.410-29 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.572-94 (July-Aug. 1982). [received: April 1983]
Results of spectral and angular measurements of solar radiation in deep layers of Venus' atmosphere, made by Venera-11 and -12, are presented. The measurements of spectra and of angular scans were carried out over an altitude range from 63 km to the surface. (50 refs.)

69521 Formation of the plasma mantle in the Venus magnetosphere. L.M.Zelenyi, O.L.Vaisberg.
Cosmic Res. (USA), vol.20, no.4, p.438-51 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.604-19 (July-Aug. 1982). [received: April 1983]
A model is proposed for the interaction of the solar wind with Venus, including the formation of the magnetic barrier characteristics of the ionopause, plasma dynamics in the magnetic barrier, and formation of Venus' tail. The formation of the magnetic tail is determined by convection of force tubes from the magnetic barrier, where the solar-wind plasma is replaced by ions of planetary origin. The possible role of anomalous ionization in the interaction of the solar wind and Venus is examined. (28 refs.)

69522 Reply to the critique of Reasenberg and Bills on 'Elastic thickness of the Venus lithosphere estimated from topography and gravity'. A.Cazenave, K.Dominh (Groupe de Recherche de Geodesie Spatiale, Centre Nat. d'Etudes Spatiales, Toulouse, France).
Geophys. Res. Lett. (USA), vol.10, no.3, p.196-8 (March 1983).
For original see ibid., vol.10, no.1, p.93-6 (1983). The authors re-examine their earlier conclusions (Cazenave and Dominh, ibid., vol.8, p.1039-42, 1981), namely that the lithosphere of Venus may partially support moderate topographic features located in the rolling plains province and that the elastic thickness of the lithosphere in that province is of the order of 10 km, in the light of the arguments of Reasenberg and Bills (1983), who find an elastic thickness of about 120 km. They conclude that the results of Cazenave and Dominh (1981) are compatible with the data used, and that even the more refined topographic and gravity data published by Reasenberg et al. (1981) cannot support the conclusions drawn by Reasenberg and Bills (1983). (7 refs.)

69523 Atomic oxygen emissions observed from Pioneer Venus. R.R.Meier, D.E.Anderson,Jr. (E.O. Hulburt Center for Space Res., Naval Res. Lab., Washington, DC, USA), A.I.F.Stewart.
Geophys. Res. Lett. (USA), vol.10, no.3, p.214-17 (March 1983).
Atomic oxygen features at 1304 and 1356 Å detected by the Orbiting Ultraviolet Spectrometer (OUVS) on Pioneer Venus are compared to theoretical emission models. Limb scans from three orbits of the O I 1304 Å emission were analyzed using an improved model which removes the restrictive assumptions of complete frequency redistribution and isothermal multiple scattering. Data-model comparisons indicate the OI 1304 Å emission rates observed are consistent with an O density 40% of the DUS model. It is also found that the emission at 1356 Å is consistent with the sum of the CO fourth positive band at 1352 Å and the O I doublet at 1356, 1358 Å, if an O density equal to 40% of the BUS model is used to calculate the O I emission rate. (21 refs.)

69524 Sulfur trioxide in the lower atmosphere of Venus?. R.A.Craig, R.T.Reynolds, B.Ragent, G.C.Carle, F.Woeller, J.B.Pollack (NASA, Ames Res. Center, Moffett Field, CA, USA).
Icarus (USA), vol.53, no.1, p.1-9 (Jan. 1983).
Measurements of Venus' atmospheric composition taken during the Pioneer Venus and Venera missions are reexamined within the context of thermodynamic equilibrium in the lower atmosphere. The implications of several atmospheric descriptions which assume that selected subsets of data are correct are investigated. One of these scenarios, assuming that the O_2 and SO_2 concentrations reported by the Pioneer Venus gas chromatograph are correct and that the H_2O concentrations reported by Venera 11 are correct, leads to the interesting possibility that large concentrations of SO_3 are present in the lower atmosphere. Such quantities of SO_3, however, lead to difficulties in explaining the atmosphere at and above the cloud tops as well as requiring specific assumptions regarding chemical reaction rates at and near the surface. (24 refs.)

69525 The clouds of Venus: sulfuric acid by the lead chamber process. G.T.Sill (Lunar & Planetary Lab., Univ. of Arizona, Tucson, AZ, USA).
Icarus (USA), vol.53, no.1, p.10-17 (Jan. 1983).
The Pioneer Venus atmospheric probe provided new data on the clouds of Venus. A model consistent with these data involves SO_2 being oxidized to H_2SO_4 by NO_x in the presence of H_2O. NO_x also forms nitrosylsulfuric acid ($NOHSO_4$) dissolved in the H_2SO_4 droplets. This acid solution, along with SO_2 and perhaps NO_2, can explain the UV and visible reflection spectrum of Venus. In the middle and lower clouds $NOHSO_4$ forms solid particles. (30 refs.)

69526 Venus: mesospheric hazes of ice, dust, and acid aerosols. R.P.Turco (R&D Associates, Marina del Rey, CA, USA), O.B.Toon, R.C.Whitten, R.G.Keesee.
Icarus (USA), vol.53, no.1, p.18-25 (Jan. 1983).
Speculates on the origin and physical properties of haze in the upper atmosphere of Venus. It is argued that at least four distinct types of particles may be present. The densest and lowest haze, normally seen by spacecraft, probably consists of a submicron sulfuric acid aerosol which extends above the cloud tops (at ~70 km) up to ~80 km; this haze represents an extension of the upper cloud deck. Measurements of the temperature structure between 70 and 120 km indicate that two independent water ice layers may occasionally appear. The lower one can form between 80 and 100 km and is probably the detached haze layer seen in high-contrast limb photography. This ice layer is likely to be nucleated on sulfuric acid aerosols, and is analogous to the nacreous (stratospheric) clouds on Earth. At the Venus 'mesopause' near 120 km, temperatures are frequently cold enough to allow ice nucleation on meteoric dust or ambient ions. The resulting haze is expected to be extremely tenuous, and optically invisible. (30 refs.)

69527 Global characteristics of magnetic flux ropes in the Venus ionosphere. R.C.Elphic, C.T.Russell (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.2993-3003 (1 April 1983).
These flux ropes are the most common magnetic feature of the ionosphere, being observed on more than 70% of the orbits of the Pioneer Venus orbiter passing through the dayside ionosphere. The spatial occurrence of flux ropes maximizes at altitudes near 165 km; they may occupy more than 50% of the ionospheric volume at this altitude. At higher altitudes the fractional volume occupied by ropes decreases below 20%. Characteristic radii of the ropes vary between 6 km at 160 km altitude and 15 km at 500 km altitude, and scale roughly with both the local ion gyroradius and ion inertial length. Ropes above 200 km altitude in the low zenith angle regions ($\chi<45°$) appear to have quasi-horizontal orientations, while those below 2100 km tend to be quasi-vertical. The authors describe other aspects of the flux ropes. (12 refs.)

69528 Venus' nighttime horizontal plasma flow, 'magnetic congestion', and ionospheric hole production. J.M.Grebowsky, H.G.Mayr, S.A.Curtis, H.A.Taylor,Jr. (Lab. for Planetary Atmospheres, NASA Goddard Space Flight Center, Greenbelt, MD, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3005-12 (1 April 1983).
A persistent feature of the nightside Venus ionosphere is the existence of localized magnetic field aligned columns of depleted ionization—i.e. 'holes'—in which the radial component of the field is enhanced. By analogy to the Earth's auroral regions it has been inferred that parallel electric fields can rapidly deplete the ionization. Another, complementary plasma loss mechanism at night is downward transport into the lower ionosphere where chemical depletion occurs. A simple rectilinear two dimensional MHD model is used to explore the effects of field aligned plasma loss and cooling on a dense plasma convecting across a weak magnetic field. (14 refs.)

Convective thinning of the lithosphere: a mechanism for rifting and mid-plate volcanism on Earth, Venus, and Mars ....See Entry 69174

Quasi-axisymmetric circulation and superrotation in planetary atmospheres ....See Entry 69488

Atomic carbon in the atmospheres of Mars and Venus ....See Entry 69529

96.30G Mars

69529 Atomic carbon in the atmospheres of Mars and Venus. V.A.Krasnopol'skii.
Cosmic Res. (USA), vol.20, no.4, p.430-7 (July-Aug. 1982). Translation of: *Kosm. Issled. (USSR)*, vol.20, no.4, p.595-603 (July-Aug. 1982). [received: April 1983]
Calculates the processes for forming C in the ground state and the excited state which gives emission at 1657 Å. These processes are more efficient in CO than in CO_2. The solar radiation flux is 4.5 times greater at Venus than at Mars, leading to a higher concentration of CO and an even greater disparity in the C concentrations. Saturation effects occur during resonance scattering at 1657 Å. Excitation processes during the formation of C give the main contribution to the emission. (31 refs.)

69530 The surface of Mars: a post-Viking view. M.H.Carr.
Mercury (USA), vol.12, no.1, p.2-15 (Jan.-Feb. 1983).
The author examines present conditions on Mars and their possible influence on geological processes, and then discusses the geology of the Martian surface in the light of the results obtained by the Viking spacecraft. It is concluded that Mars resembles the Earth in many ways, but that the two planets differ in the extent of crustal mobility and in the presence of abundant liquid water on Earth. Owing to the lack of crustal mobility and the slow rates of erosion and deposition, Mars is an active planet with enormous surface relief on which features with a wide range of ages are preserved in almost their original condition. (no refs.)

69531 Thermal radiative effects of atmospheric dust in the initiation of Martian Great Duststorms. S.B.Idso (Atmospheric Sci. Div., Inst. for Biospheric Res., Tempe, AZ, USA).
Speculations Sci. & Technol. (Switzerland), vol.6, no.1, p.65-8 (April 1983).
Results from experiments conducted on Earth are cited as evidence for the likelihood that the 'thermal blanketing' phenomenon of atmospheric dust should also be operative on Mars. It is then shown how this tendency for initial atmospheric dustiness to elevate surface temperatures may play a crucial role in the triggering of Martian Great Duststorms. (23 refs.)

Convective thinning of the lithosphere: a mechanism for rifting and mid-plate volcanism on Earth, Venus, and Mars ....See Entry 69174

96.30H Asteroids

69532 Speckle interferometry observations of the asteroids Juno and Amphitrite. G.Baier, G.Weigelt (Phys. Inst., Univ. Erlangen, Erlangen, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.137-41 (May 1983).
Performs digital speckle interferometry of the asteroids Juno and Amphitrite. The speckle interferograms were recorded with the Danish 1.5 m telescope at the European Southern Observatory. The measurements show that both asteroids have elliptical shapes. The diameters of Juno were measured to be 230 km±20 km (0".26) and 288 km±20 km (0.32") (24 December 1979, 6^h10^mUT), the diameters of Amphitrite were 160 km±30 km (0.11") and 255 km±30 km (0.17") (4 April 1981, 8^h30^mUT). (9 refs.)

69533 Positions of minor planets. M.Gressmann (Sternwarte Falkensee, Falkensee-Finkenkrug, Germany).
Astron. Nachr. (Germany), vol.304, no.1, p.55-7 (1983). In German.
Presents topocentric positions of 22 minor planets form Falkensee, GDR. The coordinates are given for the epoch 1950.0. (2 refs.)

96.30K Jupiter

69534 Rocket detection of ultraviolet emission from neutral oxygen and sulfur in the IO torus. S.T.Durrance, P.D.Feldman, H.A.Weaver (Dept. of Phys., Johns Hopkins Univ., Baltimore, MD, USA).
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L125-9 (15 April 1983).
Ultraviolet spectra (1150+1750 Å) of the Io plasma torus were obtained using a rocket-borne telescope and spectrometer in 1981 May. Separate spectra of the torus and terrestrial airglow emissions were acquired simultaneously to facilitate accurate background subtraction. Two emissions of the neutral component of the torus are identified: the S I (^3P-^3D) multiplet at 1425 Å, with a brightness (averaged over the 15"×110" aperture) of 2.5±1.3 R; and an emission feature at 1304 Å, with a brightness of 4.2±2.0 R, assigned to both the O I (^3P-^3S) and S I (^3P-^3P) multiplets in the ratio O I:S I≈2:1. This is the first detection of S I as a component of the torus. The instrument field of view intersected the torus near its eastern ansa while Io was near western elongation, so this measurement indicates that an extended neutral atomic cloud is associated with the torus. Also identified are the ionic emissions of S II λ1256 (4.5±1.6 R), S III λ1199 (15±8 R), and S IV λ1406 (2.0±1.0 R). The strong feature at 1729 Å, first observed by the International Ultraviolet Explorer and tentatively as S III, has a brightness of 17.3±4.0 R. (21 refs.)

69535 Dawn-dusk electric field asymmetry of the Io plasma torus. D.D.Barbosa, M.G.Kivelson (Inst. of Geophys. & Planetary Phys., Univ. of California, Los Angeles, CA, USA).
Geophys. Res. Lett. (USA), vol.10, no.3, p.210-13 (March 1983).
The authors consider the effects of a combined convection and corotation electric field across to the Io plasma torus. A dawn-to-dusk electric field E_c will modify the orbits of charged particles shifting them toward dawn. The radial drift imposed by the perturbed orbits implies a local time-dependent modulation of low-energy ion and electron temperatures with particles hotter at dusk than at dawn. With $E_c \simeq 4$ mV/m, the orbits near 6 R_J would be shifted by approximately 0.2 R_J. Then the electron temperature would be 20% higher at dusk than at dawn, an effect which could explain the local time asymmetry of EUV intensity found by the Voyager ultraviolet spectrometer. The source of the convection electric field is internal to the magnetosphere and is attributed to the tailward escape of Iogenic and Jovian plasma beyond the Alfven surface. (18 refs.)

69536 Orbital evolution of the Galilean satellites: capture into resonance. J.Henrard (Dept. of Math., Facultes Univ. Notre-Dame de la Paix, Namur, Belgium).
Icarus (USA), vol.53, no.1, p.55-67 (Jan. 1983).
Yoder's scenario (1979) for the capture into resonance of the first three Galilean satellites is reexamined. A more refined dynamical model for the resonance and for the tidal effects is proposed and analyzed. The results agree qualitatively with those of Yoder but differ numerically by 10 to 20%. (9 refs.)

69537 The $^{12}C/^{13}C$ ratio in Jupiter from the Voyager infrared investigation. R.Courtin (Lab. de Phys. Stellaire et Planetaire, Verrieres-le-Buisson, France), D.Gautier, A.Marten, V.Kunde.
Icarus (USA), vol.53, no.1, p.121-32 (Jan. 1983).
The $^{12}C/^{13}C$ ratio in Jupiter has been derived from that analysis of the ν_4 band of CH_4 in the spectra recorded by the Voyager 1 IRIS experiment. It is found to be 160_{-55}^{+40}. Instrumental noise as well as systematic sources of error were taken into account for the estimate of the uncertainty. No plausible theory predicts such a difference as there is between the values of the $^{12}C/^{13}C$ ratio in the inner Solar System and in Jupiter. However, values of this ratio in the solar neighborhood 4.5 by ago inferred—through the use of models of chemical evolution of the Galaxy—from recent interstellar medium measurements are compatible with the present determination in Jupiter. The Jovian value, rather than the terrestrial one, could then be representative of the ratio of the primitive solar nebula. (47 refs.)

69538 Further observations of 8-μm polar brightenings of Jupiter. J.Caldwell, A.T.Tokunaga (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA), G.S.Orton.
Icarus (USA), vol.53, no.1, p.133-40 (Jan. 1983).
North to south scans of Jupiter at 7.8-μm wavelength in early 1981 confirm polar brightening events that correlate with LCM_{III}, such that a polar limb is bright when the corresponding magnetic pole is tilted earthward. The correlation with magnetic features of the planet suggests that the energy source for the brightenings is magnetospheric particles incident upon the polar regions of the atmosphere. The northern polar events are more prominent and more regular than the southern ones. The polar emission may be indirectly related to the ultraviolet absorber observed near the poles by Voyager 2. (8 refs.)

69539 Alfven wave propagation in the Io plasma torus. F.Bagenal (Center for Space Res., MIT, Cambridge, MA, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3013-25 (1 April 1983).
Plasma measurements that were made by the Voyager 1 plasma science experiment have been combined with a model of Jupiter's magnetic field to calculate the time an Alfven wave takes to travel between Io and Jupiter's ionosphere and the period of subsequent bounces between the northern and southern hemispheres. The result is a wave pattern extending around Jupiter as the multiple reflected Alfven waves are carried away from Io by the corotating magnetospheric plasma. Although the whole pattern continually changes over the 13 hours Io takes to move through 360° of Jovigraphic longitude, a general longitudinal structure is exhibited independent of the position of Io, due to the geometry of the magnetic field and the distribution of plasma in the Io torus. (34 refs.)

69540 Kelvin-Helmholtz instability and the Jovian Great Red Spot. M.V.Nezlin, E.N.Snezhkin, A.S.Trubnikov (I.V. Kurchatov Inst. of Atomic Energy, Moscow, USSR).
JETP Lett. (USA), vol.36, no.6, p.234-8 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.190-3 (20 Sept. 1982). [received: April 1983]
It has been shown experimentally, for the first time, that the Kelvin-Helmholtz instability is manifested by a predominant generation of anticyclonic Rossby solitons in a model of a homogeneous atmosphere of a rotating planet. These solitons drift opposite the global rotation. Their properties and the conditions for their existence are reminiscent of the vortex at the Jovian Great Red Spot. (10 refs.)

S II and S III branching ratios in the 600- to 1200-Å interval ....See Entry 65915

Maximizing the entry corridor and minimizing energy expenditures during insertion of a spacecraft into the orbit of an artificial satellite of Jupiter by a composite method ....See Entry 69475

Quasi-axisymmetric circulation and superrotation in planetary atmospheres ....See Entry 69488

Monopole heat ....See Entry 69495

96.30M Saturn

69541 On the equatorial transport of Saturn's ionosphere as driven by a dust-ring current system. W.-H.Ip (Max-Planck-Inst. fur Aeronomie, Katlenburg-Lindau, Germany), D.A.Mendis.
Geophys. Res. Lett. (USA), vol.10, no.3, p.207-9 (March 1983).
The diurnal modulation of the dust ring current of Saturn's D-ring causes field-aligned Birkeland currents to flow near the dawn and dusk terminators and close across the mid-latitude ionosphere. One consequence of this current system is the establishment of a global convection pattern in the equatorial outer ionosphere. Outward motion of the dayside ionospheric plasma as well as the corresponding absorption effect of the inner ring system might be one physical cause of the depletion of the ionospheric content of Saturn. (15 refs.)

69542 The dark side of Iapetus. D.P.Cruikshank (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA), J.F.Bell, M.J.Gaffey, R.Hamilton Brown, R.Howell, C.Beerman, M.Rognstad.
Icarus (USA), vol.53, no.1, p.90-104 (Jan. 1983).
Presents new photometric and spectrophotometric observations of the dark (leading) hemisphere of Saturn's satellite Iapetus. Spectrophotometry from 0.3-1.0 μm (May 1979) shows the dark hemisphere to be very red, similar to a few asteroids and the Moon, but with no spectral features attributable to olivine or pyroxene. Near-infrared spectrophotometry in the regions 1.4-2.5 μm (May 1981) and 3.0-3.8 μm (February 1981) reveals water ice absorption bands, probably resulting from the polar caps intruding onto the dark hemisphere. The reflectance of Iapetus most closely resembles the reflectance (and low albedo) of carbonaceous (organic) residue from the Murchison C2 carbonaceous chondrite. Three hypotheses for the formation of the dark hemisphere are discussed in light of the observational data. The favored hypothesis is that debris from Phoebe or other unknown outer satellites of Saturn impacts the dark hemisphere of Iapetus as Poynting-Robertson drag causes the debris to spiral toward Saturn. (51 refs.)

69543 Viscosity of the lithosphere of Enceladus. Q.R.Passey (Div. of Geological & Planetary Sci., California Inst. of Technol., Pasadena, CA, USA).
Icarus (USA), vol.53, no.1, p.105-20 (Jan. 1983).
High resolution Voyager II images of Enceladus reveal that some regions on its surface are highly cratered; the most heavily cratered surfaces probably date back to a period of heavy bombardment. The forms of many of the craters on Enceladus are similar to those of fresh lunar craters, but many of the craters are much shallower to depth, and the floors of some craters are bowed up. The flattening of craters and bowing up of the floors are indicative of viscous relaxation of the topography. The flattened craters are located in distinct zones that are adjacent to zones, of similar age, where craters have not flattened. The zones where flattened craters occur possibly are regions in which the heat flow was (or is) higher than that in the adjacent terrains. It can be concluded that the lithospheric material on Enceladus is different from that of Ganymede and Callisto. (20 refs.)

69544 Orbits of Saturn's F ring and its shepherding satellites. S.P.Synnott, R.J.Terrile, R.A.Jacobson (Jet Propulsion Lab., Pasadena, CA, USA), B.A.Smith.
Icarus (USA), vol.53, no.1, p.156-8 (Jan. 1983).
The shape and orientation of Saturn's F ring and the orbits of its two shepherding satellites have been determined from Voyager images. The data and processing are described, and orbital parameter estimates and associated uncertainties are presented. In addition, evidence that suggests that the F-ring braids are formed very near the conjunctions of the shepherding satellites is presented. (4 refs.)

69545 Atmospheric storm explanation of Saturnian electrostatic discharges. M.L.Kaiser, J.E.P.Connerney, M.D.Desch (Goddard Space Flight Center, NASA, Greenbelt, MD, USA).
Nature (GB), vol.303, no.5912, p.50-3 (5 May 1983).
The Voyager Planetary Radio Astronomy (PRA) experiments detected an impulsive (15-400 ms), broadband (20 kHz to 40 MHz) radio emission component that persisted throughout the two Saturn encounter periods. These bursts were grouped into episodes which recurred with a period of about 10 h 10 min, distinctly faster than the Saturnian rotation period of 10 h 39.4 min. This periodicity, coupled with the occurrence dependence on distance rom Saturn, led Warwick et al. (1981, 1982) to conclude that the bursts were related to the Saturn system and coined the term SED for Saturn electrostatic discharges. The authors analyse these SED episodes paying particular attention to their occurrence in both time and frequency as a function of spacecraft-Saturn geometry during the Voyager 1 encounter. From the model, the authors infer the ionospheric electron density near Saturn's noon meridian and over the night hemisphere. (16 refs.)

Quasi-axisymmetric circulation and superrotation in planetary atmospheres ....See Entry 69488

96.30T Other planets

69546 New observational constraints on the temperature inversions of Uranus and Neptune. A.T.Tokunaga (Inst. for Astron., Univ. of Hawaii, Honolulu, HI, USA), G.S.Orton, J.Caldwell.
Icarus (USA), vol.53, no.1, p.141-6 (Jan. 1983).
Presents 20-μm photometry of Uranus and Neptune which confirms the presence of a temperature inversion in the lower stratospheres in both planets. The authors find the brightness temperature difference between 17.8 and 19.6 μm to be 0.8 ± 0.5K for Uranus and 1.8 ± 0.6K for Neptune. These results indicate that the temperature inversions on both planets are weaker than previously thought. Comparison with model atmospheres by Appleby (1980) indicates that the temperature inversions can be understood as arising from heating by the absorption of sunlight by CH_4 and aerosols. However, the stratospheric CH_4 mixing ratio on Neptune must be higher than that at the temperature minimum. (25 refs.)

96.50 OTHER OBJECTS IN THE PLANETARY SYSTEM

96.50D Interplanetary matter, magnetic and electric fields

(inc. gegenschein and zodiacal light; see also 94.60 Interplanetary space)

69547 Extraterrestrial Lyman α and helium 584 Å resonance radiation from the near solar system. A.Rea.
Univ. Wales, Swansea thesis, Sept. 1982
Critically reviews observations and theoretical work concerning hydrogen Lyman α and helium 584 Å emissions from interplanetary space. The subject is treated in detail from the early exploratory stage to the present day. A description of the experimental apparatus and methods of data analysis is given.

96.50G Comets

69548 Astrometry and photometry of comet P/Halley in October and November 1982. B.Sicardy, J.Guerin, J.Lecacheux, J.Baudrand, M.Combes (Section d'Astrophys., Obs. de Paris-Meudon, Meudon, France), J.P.Picat, G.Lelievre, J.P.Lemonnier.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.L4-6 (May 1983).
Comet P/Halley (1982i) has been observed at the Canada-France-Hawaii 3.6-m Telescope on October 17th, November 15th and 16th, 1982, using an electronographic camera. Positions were measured with an accuracy of ± 1.5 arc sec. The B-magnitude was 24.6 ± 0.4 in November 1982. Data reduction procedures are presented. A value of the nuclear radius is derived. (9 refs.)

69549 P/Halley: first signs of activity?. R.M.West, H.Pedersen (European Southern Obs., Garching, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.L11-12 (May 1983).
A comparison of two broad-band CCD exposures (3700-7800 Å) of P/Halley (1982i) on 10 December 1982 and 14 January 1983, with the Danish 1.5 m telescope on La Silla, indicates a brightness increase of $1.0^m \pm 0.4^m$. The January image is broader than the seeing disc, although this may partly be a guiding effect. It is possible that the first signs of nuclear activity have been observed at $\sim$10.5 AU. Accurate positions have been measured. (8 refs.)

69550 Electrodynamics of submicron dust in the cometary coma. M.K.Wallis, M.H.A.Hassan (Dept. of Appl. Maths. & Astron., Univ. Coll. of Cardiff, Cardiff, Wales).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.10-14 (May 1983).
Electromagnetic forces derived from the solar wind fields act strongly on submicron dust grains in the cometary coma. The grain charge and thus the forces are sensitive to composition and cometary plasma conditions, as well as to grain size. For dielectric grains of 0.1 μm and conducting grains of 0.3 μm or less, the electromagnetic forces dominate over radiation pressure. The stronger accelerations may produce fan-like structures as sometimes observed. They would also cause grains to circumvent the shields designed to protect the Giotto and Vega spacecraft speeding through comet Halley's dust coma. (29 refs.)

69551 New Comet IRAS-Araki-Alcock 1983d. S.W.Milbourn.
Br. Astron. Assoc. Circ. (GB), no.634, 1 pp. (9 May 1983).
It is reported that a large, diffuse comet was discovered on 1983 April 25 by the IRAS satellite and independently on 1983 May 3 by C. Araki and G.E.D. Alcock. A very close approach to the Earth is predicted for May 11-12, with a minimum distance of 0.03 AU; at this time the magnitude of the comet will be around +2, and its diameter is expected to exceed 1°. Parabolic orbital elements are given for the comet, together with an ephemeris for the period 1983 May 5 to 21, at one-day intervals. (no refs.)

69552 Periodic Comet Tempel 2 (1982d). D.W.E.Green.
I.A.U. Circ. (USA), no.3794, 1 pp. (29 April 1983).
An ephemeris is presented for the period 1983 May 6 to September 23, at ten-day intervals. (2 refs.)

69553 Comet IRAS-Araki-Alcock (1983d).
I.A.U. Circ. (USA), no.3796, 1 pp. (4 May 1983).
It is reported that a large, bright comet was discovered on 1983 April 25 by the IRAS satellite and independently on May 3 by Genichi Araki and G.E.D. Alcock. Twelve positions are reported for the period 1983 April 25 to May 4; these include five precise positions measured on April 27 and May 2. The comet brightened from 7th to 6th magnitude between May 3 and May 4; its diameter on May 4 was 18′. (no refs.)

69554 Comet IRAS-Araki-Alcock (1983d). B.G.Marsden.
I.A.U. Circ. (USA), no.3797, 1 pp. (4 May 1983).
The author reports parabolic orbital elements for this comet together with an ephemeris for the period 1983 May 4 to 8 (at one-day intervals) and for the period 1983 May 8 to 16 (at half-day intervals). It is predicted that the comet will approach to within 0.034 a.u. of the Earth on 1983 May 11, and that it will reach magnitude 2.2 at this time. (no refs.)

69555 Periodic Comet Kopff (1982k). J.-C.Merlin, J.Bortle, C.S.Morris.
I.A.U. Circ. (USA), no.3797, 1 pp. (4 May 1983).
Total visual magnitude estimates are reported for the period 1983 March 20 to April 18; the comet brightened from magnitude 12.7 to magnitude 10.9 during the period of the observations. (no refs.)

69556 Comet IRAS-Araki-Alcock (1983d). T.Oja, G.Hahn, R.McNaught, K.Ishida, P.Stattmayer, G.Bothun, J.Patterson, D.W.E.Green.
I.A.U. Circ. (USA), no.3804, 1 pp. (11 May 1983).
27 precise positions are reported, covering the period 1983 May 1 to 11. (no refs.)

69557 Comet IRAS-Araki-Alcock (1983d). R.P.Boyle, B.L.Lutz, R.M.Wagner, R.McNaught, D.Machholz, D.W.E.Green, B.G.Marsden.
I.A.U. Circ. (USA), no.3805, 1 pp. (11 May 1983).
It is reported that polarimetric observations of Comet IRAS-Araki-Alcock on 1983 May 5 and 6 showed the linear polarisation to be 25% in V, R and I, and somewhat less in U and B; observations using a narrow-band (5 nm) filter at 385 nm gave a linear polarisation of 13%. Spatially-resolved spectrophotometric observations between 380 and 640 nm, also on 1983 May 5 and 6, showed the coma to exhibit the characteristic emission features of CN, C_3, C_2, NH_2, and [O I]. The nuclear region, which appeared highly condensed, showed a strong reflective continuum superimposed on the gaseous emissions. Naked-eye estimates of total magnitude and coma diameter are presented for the period 1983 May 9 to 11. Finally, improved parabolic orbital elements are given, together with an ephemeris for the period 1983 May 16 to June 25, at five-day intervals. (no refs.)

69558 Comet Sugano-Saigusa-Fujikawa (1983e). E.Everhart, B.Skiff, C.Lugenbuhl, M.Koishikawa, E.Mayer, J.Young, R.Oster, D.Machholz.
I.A.U. Circ. (USA), no.3807, 1 pp. (11 May 1983).
The authors report three precise positions for the epoch 1983 May 9 and three approximate positions for 1983 May 10. (1 ref.)

69559 Periodic Comet Tempel 1 (1982j). J.-C.Merlin, C.E.Spratt, J.Bortle.
I.A.U. Circ. (USA), no.3807, 1 pp. (11 May 1983).
Total visual magnitude estimates are reported for the period 1983 April 13 to May 5; the comet brightened from magnitude 10.8 to magnitude 9.5 during the period of the observations. (no refs.)

Evolution of cometary perihelion distances in Oort cloud: another statistical approach ....See Entry 69517

Meteoroid cluster produced by Halley's Comet ....See Entry 69562

96.50K Meteors, showers and meteoroids

69560 New aspects in single-body meteor physics. P.Pecina, Z.Ceplecha (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.102-21 (March 1983).
Integration of the single-body differential equations of motion and ablation of a meteoroid in the atmosphere (Hoppe, 1937) with constant coefficients result in an analytical expression for the distance along the trajectory as a function of time. Initial and terminal velocities, and a value of the average ablation coefficient for the entire trajectory are determined. Expressions at the maximum-deceleration point are given and applied to compute ablation coefficients for 17 Prairie Network fireballs observed below this point and for the Innisfree fireball. A model of luminous efficiencies for small velocities and for masses up to several hundred grams is proposed and applied to separate the shape-density coefficient from the meteoroid mass. (17 refs.)

69561 Dependence of the observed rate of meteors on the zenith distance of the radiant. J.Zvolankova (Astron. Inst., Acad. of Sci., Bratislava, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.122-8 (March 1983).
Using more than 17000 visual records of the Perseids made at the Skalnate Pleso Observatory over a period of 9 years, the exponent γ in the reduction factor $\cos^{\gamma} z$ is derived for reducing the rate of meteors observed at zenith distance of the radiation z to the rate when the radiant is in the zenith. The value of the exponent thus obtained, $\gamma=1.47\pm0.11$, is very close to the average of the extremes used, $\gamma=1$ and $\gamma=2$. (16 refs.)

69562 Meteoroid cluster produced by Halley's Comet. A.N.Simonenko.
Priroda (USSR), no.2, p.28-35 (1983). In Russian.
A study is made of the very rarefied closed elliptical cluster of meteoroids located along the orbit of Periodic Comet Halley. The process of cluster formation is analysed and the question of the actual composition of the meteoroids is considered, with comments on research to date. The Comet Halley cluster is singled out for special study as a cluster with two meteor showers (the May Aquarids and the Orionids) and the evolution of the orbit of the comet is traced with details of old and future observations of the meteor showers. (4 refs.) *L.M.H.*

96.50M Meteorites, micrometeorites

69563 Isotopic anomalies: early history of the Solar System. P.Bochsler (Phys. Inst., Univ. of Bern, Bern, Switzerland).
Europhys. News (Switzerland), vol.14, no.2, p.1-3 (Feb. 1983).
Outlines the results of isotopic composition analysis on the ALLENDE meteorite, which fell in 1969. (3 refs.)

69564 Extraterrestrials have landed on Antarctica. U.B.Marvin (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
New Sci. (GB), vol.97, no.1349, p.710-15 (17 March 1983).
Within the past decade the thick ice sheet that covers Antarctica has yielded more than 5000 fragments of meteorite. The vast majority are specimens of stony meteorites, types already abundant in the world's museums; but a few have proved to be entirely new species. In addition, about 36 fragments of metallic nickel-iron meteorites have been collected, one of which contains minute diamonds, and is only the second of its kind known in the world. Indeed, the ice sheet's frozen cargo may include meteorite specimens derived not only from the fragmentation of asteroids and possibly of comets but also from the Moon and Mars. Results of preliminary studies on a meteorite found by a US party in the final days of its 1981-82 expedition to Antarctica are discussed. The 31-gram specimen, about the size of an apricot, has properties in common with 'soils' from the lunar highlands. If the evidence proves conclusive, this will be the first piece of the Moon ever found on Earth. In addition, new data strengthen the idea that a group of nine unusual stony meteorites may have come from Mars. Two of the specimens were found in Antarctica, and one each in Egypt, France, Brazil, the US, Nigeria, India and Australia. Thus, years after the US and the USSR last sent space probes to the Moon to gather rock samples, a rich harvest of exciting new examples from space is turning up on Earth and which often raise more questions than they answer. (no refs.)

45th Annual Meeting of the Meteoritical Society (papers in summary form only received) ....See Entry 64581

Some cosmochemical consequences of a turbulent protoplanetary cloud ....See Entry 69516

96.60 SOLAR PHYSICS

69565 OSO-8 observations of a quiescent prominence: a comparison of Lyman-α with theoretical intensities. P.Heinzel (Astron. Inst., Czechoslovak. Acad. of Sci., Ondrejov, Czechoslovakia), J.-C.Vial.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.155-7 (May 1983).
Using simultaneous observations of hydrogen Lyman-α and Ca II K lines obtained with the OSO 8 LPSP instrument, the authors compare Lα emission from a quiescent prominence with those predicted from the existing theoretical models. The authors use the observed relation between Hα and Ca II K integrated intensities to obtain an estimate of $E(\mathrm{H}\alpha)/E(\mathrm{L}\alpha)$ vs. $E(\mathrm{H}\alpha)$. This ratio differs significantly from those predicted theoretically under the assumption of complete frequency redistribution during the scattering of Lα photons. On the other hand, using the partial-redistribution treatment in the Lα wings, as suggested for prominences by Miley et al. (1979), the authors arrived at a reasonable agreement with the corresponding theoretical curve. The possible influence of macroscopic velocities on line ratios is briefly discussed. (19 refs.)

69566 Observable physical effects during new solar active regions formation. V.Bumba (Astron. Inst., Czechoslovak Acad. of Sci., Ondrejov, Czechoslovakia).
Astron. Nachr. (Germany), vol.304, no.1, p.7-12 (1983).
Demonstrates the importance of detailed observations for the theory of solar local magnetic field generation. Mutual relations between solar background magnetic fields and new active regions formation are described. The influence of various factors on the cycle of solar activity and the dynamics of background fields is considered. All forces and effects whose action can be derived from systematic observations of magnetic field distribution and high resolution photospheric photographs of all stages of active region development are discussed. The influence of convection, field lines penetration, various magnetic forces, differential rotation and hydrodynamical forces is demonstrated. The importance of a 'center of magnetic activity' as a source of new magnetic flux is underlined. The necessity of a new approach to the problem of local magnetic field generation is stated. (22 refs.)

69567 Coronal index of solar activity. IV. Years 1964-1970 [with comment]. M.Rybansky, V.Rusin, J.Sykora (Astron. Inst., Slovak Acad. of Sci., Lomnica, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.79-96 (March 1983).
For pt.III see ibid., vol.30, no.2, p.104-13 (1978). Reports the values of the coronal index of solar activity for the years 1964-1970, determined using the method described by Rybansky (1975). The index is expressed in terms of the total energy emitted by the whole visible corona in emission line Fe XIV$-$530.3 nm. A graph showing the behaviour of the index during the 20th cycle of solar activity (monthly averages) is given. (7 refs.)

69568 The motions of the umbrae in Hale Active Regions 16862 and 16.863. A.Antalova (Astron. Inst., Slovak Acad. of Sci., Lomnica, Czechoslovakia).
Bull. Astron. Inst. Czech. (Czechoslovakia), vol.34, no.2, p.96-9 (March 1983).
Substantial changes of the orientations of the geometrical axis of the umbra of the Hale AR 16863 was observed from 22 to 24 May 1980. The average angular velocity was -1.8 degree per hour. The axes of the both main umbrae of the AR 167862 also rotated after 24 May 1980. These spots were preferred locations of the umbral subflares. (1 ref.)

69569 The great solar anomaly ca. 1780-1800: an error in compiling the record?. G.P.Sonett (Planetary Sci. Dept., Univ. of Arizona, Tucson, AZ, USA).
J. Geophys. Res. (USA), vol.88, no.A4, p.3225-8 (1 April 1983).
The view that the sunspot index time sequence is of lessened validity prior to about 1850 is shown to be consistent with an error in the 1780-1800 time period when phase, offset of the Hale carrier sinusoid from zero mean, and the amplitude modulation envelope all show a lack of conformity with respect to the remainder of the record subsequent to the Maunder minimum. This lack of conformity is consistent with an error that delays one or more of the 11-year cycle minima but recovers phase subsequently. This type of error creates a strongly coherent set of companion changes in offset of the carrier from zero mean and in the amplitude modulation envelope. (12 refs.)

69570 Thermal balance and magnetostatic equilibrium in a uniform gravity field. Wang Shui (Univ. of Sci. & Technol. of China, Hefei, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.11, p.1163-6 (Nov. 1982). [received: April 1983]
The equation of magnetostatic equilibrium of a plasma in a uniform gravity field is applied widely in solar physics. Many phenomena in the solar atmosphere such as sunspots, quiescent prominences and various other chromospheric, and coronal structures can last several hours to several days. In the solar atmosphere, the energy transport produced by thermal conduction, radiative loss and heat source (for example, heat from the dissipation of waves) are very important. The author derives the general form of the couple equation between the temperature field and the magnetic field, and also obtains the self-consistent solutions of thermal balance and magnetostatic equilibrium of a 2-dimensional plasma in a uniform gravity field. (7 refs.)

69571 Principal and dielectronic satellite line spectra for Ca XIX: SMM observations. A.K.Pradhan (Dept. of Phys., Univ. of Windsor, Windsor, Ontario, Canada).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.35p-8 (May 1983).
Atomic processes and data relevant to the interpretation of SMM observations of Ca XIX are discussed, with particular reference to the work by Bely-Dubau et al. (1982). (15 refs.)

69572 Has rapid solar core rotation been observed?. B.N.Andersen, P.Maltby (Inst. of Theoretical Astrophys., Univ. of Oslo, Oslo, Norway).
Nature (GB), vol.302, no.5911, p.808-10 (28 April 1983).
Shows that the phase as well as the magnitude of the observed 13.1 ± 0.2 day velocity signal amplitude may be predicted without any rapid core rotation by taking into account the presence of sunspots and their contribution to the spectral line profile as integrated over the disk of the Sun. It is concluded that the existence of a 13.1-day apparently periodic velocity signal with amplitude 6.5 m s^{-1} during the 88 days observing period cannot be taken as evidence for a rapidly rotating solar core. (11 refs.)

69573 Solar atmospheric temperature inhomogeneities induce a 13-day oscillation in full-disk Doppler measurements. M.G.Edmunds (Dept. of Appl. Math. & Astron., Univ. Coll. Cardiff, Cardiff, Wales), D.O.Gough.
Nature (GB), vol.302, no.5911, p.810-12 (28 April 1983).
Points out that the passage of active regions across the disk could be responsible for a 13-day oscillation in full-disk solar spectrum-line shifts. Variations in line shifts and in irradiance are expected with frequencies comparable to both the photospheric rotation rate and to higher harmonics. For line-shift oscillations the power in the second harmonic is substantially greater than it is for irradiance variations. Therefore a prominent 13-day component is not surprising, especially as the second harmonic is strong in the sunspot distribution. The amplitude, period and phase that would be expected to have been found in line-shift data are estimated. It is suggested that the 13-day oscillation is a direct consequence of the inhomogeneity of the solar surface. (20 refs.)

69574 A mathematical model of solar flares. J.Heyvaerts (Obs. de Meudon, Meudon, France), J.-M.Lasry, M.Schatzman, P.Witomski.
Q. Appl. Math. (USA), vol.41, no.1, p.1-30 (April 1983).
The phenomenon of solar flares is modeled assuming that the magnetic field is force-free and that its evolution is quasi-static. This model is simplified so as to be tractable and yields a semi-linear elliptic equation in a halfplane depending on a parameter λ which describes the time evolution. It is proved that there are (at least) two branches of solutions which have distinct asymptotic behaviors at infinity. The upper branch exists for all $\lambda>0$, but the lower branch exists only on a finite interval $[0,\lambda^c]$. As stable solutions must have the same asymptotic behavior as the lower branch of solutions, and as this is

impossible after λ^c, the authors contend that no stable solution exists after λ^c and that a solar flare is thus triggered. (24 refs.)

69575 On possible correlations in the photospheric magnetic field. S.G.Wallenhorst (Mount Wilson & Las Campanas Obs., Carnegie Inst. of Washington, Washington, DC, USA).
Sol. Phys. (Netherlands), vol.83, no.2, p.191-4 (March 1983).
Searches for correlations between photospheric magnetic field changes in the north and south hemispheres of the Sun. Both active region logs and analysis of Mount Wilson magnetograms were employed. No correlations were found, and it is inferred that local convective turbulence is more important than dynamic processes with regard to the appearance of individual active regions. (6 refs.)

69576 Non-axisymmetric magnetostatic equilibrium. I. A perturbation theory. W.R.Hu, Y.Q.Hu, B.C.Low (High Altitude Obs., Nat. Center for Atmospheric Res., Boulder, CO, USA).
Sol. Phys. (Netherlands), vol.83, no.2, p.195-205 (March 1983).
Considers the structural properties of a sunspot-like magnetic flux tube which lacks perfect axisymmetry. The flux tube is taken to be in static equilibrium with an atmosphere in a uniform gravity. Assuming the departure from axisymmetry to be slight, the equations for the first order non-axisymmetric part of the equilibrium are derived in cylindrical coordinates. These first order equations reduce to a linear second order hyperbolic partial differential equation in the *r-z* plane. Physical considerations dictate the specifications of boundary conditions on a closed curve. The construction of solutions to this boundary value problem is illustrated with three analytically soluble cases of different complexity. A physical discussion of the results is given. (12 refs.)

69577 A statistical analysis of Na I D_1 profile fluctuations at the center of the solar disk. I. Data reduction and resolvable velocities. F.N.Edmonds,Jr., J.-C.Hsu (Dept. of Astron., Univ. of Texas, Austin, TX, USA).
Sol. Phys. (Netherlands), vol.83, no.2, p.217-32 (March 1983).
Three radial-velocity fluctuation arrays $V(\Delta\lambda,Y)$ and line-formation fluctuation arrays $L(\Delta\lambda,Y)$, where $\Delta\lambda$ is wavelength displacement from the center of Na I D_1 and Y is displacement on the Sun's surface along the spectrograph slit, were obtained from Sacramento Peak Observatory spectrograms. The variations of these line profile fluctuations are qualitatively described. The RMS$_v$s, coherences, and power spectra shapes for $V(\Delta\lambda,Y)$ fluctuations are examined at different $\Delta\lambda$ with the corresponding effective heights of formation calculated with Mein weighting functions. (48 refs.)

69578 The solar corona on 31 July, 1981. R.R.Fisher, L.B.Lacey, K.A.Rock, E.A.Yasukawa (High Altitude Obs., Nat. Center for Atmospheric Res., Boulder, CO, USA), N.R.Sheeley,Jr., D.J.Michels, R.A.Howard, M.J.Koomen.
Sol. Phys. (Netherlands), vol.83, no.2, p.233-42 (March 1983).
Various instruments were used to observe the solar corona near or at the time of total eclipse, 31 July, 1981. The High Altitude Observatory coronal eclipse camera and the Mk-III *K*-coronameter recorded the lower portions of the corona; the distribution of white light material above $3R_\odot$ was observed with the Naval Research Laboratory satellite coronagraph on P78-1. These data sets are used to describe coronal structure and to identify coronal active regions. A distribution of the white-light corona, derived from synoptic *K*-coronameter data, is given. (7 refs.)

69579 Analysis of the high-resolution Mg XI X-ray spectra. IV. Derivation of the plasma densities close to the 'low-density' limit. G.Bromboszcz (Astron. Inst., Wroclaw Univ., Wroclaw, Poland), M.Siarkowski, J.Sylwester, V.V.Korneev, S.L.Mandelshtam, S.N.Oparin, A.M.Urnov, I.A.Zhitnik.
Sol. Phys. (Netherlands), vol.83, no.2, p.243-55 (March 1983).
For pt.III see ibid., vol.81, no.1, p.63-8 (1982). A method is developed to evaluate plasma densities from measured resonance, intercombination, and forbidden helium-like Mg XI line intensities, using plots of the so-called *G* and *R* ratios. The density is close to the low-density limit. For the active region McMath 14352 are correlation between mean plasma density and electron temperature has been found, in agreement with earlier results. In an appendix systematic differences between measured and calculated line fluxes in all bands A to F are discussed. (24 refs.)

69580 Optical counterpart of the radio event accompanying 3B flare of 13 May 1981. R.E.Loughhead, Wang Jia-Long (Div. of Appl. Phys., CSIRO, Sydney, Australia), R.A.Duncan.
Sol. Phys. (Netherlands), vol.83, no.2, p.257-66 (March 1983).
Excepting intermittent type III activity, all the radio events over the frequency range 8-8000 MHz accompanying the initial stage of the 3B flare of 13 May 1981 had their onset in a 2-min interval immediately preceding the peak of an impulsive Hα brightening (kernel) well away from the main flare. This kernel is identified as one footpoint of a loop of magnetic flux whose other end terminated in a transient brightening in an adjacent active region. (23 refs.)

69581 X-ray and radio emissions in the early stages of solar flares. A.O.Benz (NASA/ Goddard Space Flight Center, Greenbelt, MD, USA), C.H.Barrow, B.R.Dennis, M.Pick, A.Raoult, G.Simnett.
Sol. Phys. (Netherlands), vol.83, no.2, p.267-83 (March 1983).
Radio and X-ray observations are presented for three flares which show significant activity for several minutes prior to the main impulsive increase in the hard X-ray flux. The activity in this 'pre-flash' phase is investigated using 3.5 to 461 keV X-ray data from the Solar Maximum Mission, 100 to 1000 MHz radio data from Zurich, and 169 MHz radio-heliograph data from Nancay. (21 refs.)

69582 High-resolution observations of solar radio bursts at 2, 6, and 20 cm wavelength. R.F.Willson (Dept. of Phys., Tufts Univ., Medford, MA, USA).
Sol. Phys. (Netherlands), vol.83, no.2, p.285-303 (March 1983).
The very large array and the Westerbork synthesis radio telescope have been used to observe eight solar bursts at 2, 6, or 20 cm wavelength with second-of-arc angular resolution. A series of 10 s snapshot maps are presented for the more intense bursts, and superimposed on photospheric magnetograms or Hα photographs. (26 refs.)

69583 Interpretation of patterns of drifting zebra stripes. L.Mollwo (Zentralinst. fur Solar-Terrestrische Phys. (Heinrich-Hertz-Inst.),,Berlin. Akad. der Wissenschaften,Germany).
Sol. Phys. (Netherlands), vol.83, no.2, p.305-20 (March 1983).
The earlier interpretation of the zebra patterns by the concept of double resonance is examined for a realistic magneto-hydrostatic model of a coronal condensation over a bipolar spot group. It appears that the frequency drift of the zebra stripes over a longer time can scarcely be explained by a change of state of the plasma. A modified mechanism is proposed based on a helical beam of electrons forming fronts that excite radiation at places of double resonance. (48 refs.)

69584 Solar rotation results at Mount Wilson. IV. Results. R.Howard, J.M.Adkins, J.E.Boyden, T.A.Cragg, T.S.Gregory, B.J.Labonte, S.P.Padilla, L.Webster (Mount Wilson & Las Campanas Obs., Carnegie Inst. of Washington, Washington, DC, USA).
Sol. Phys. (Netherlands), vol.83, no.2, p.321-38 (March 1983).
For pt.III see ibid., vol.80, no.2, p.361-72 (1982). Publish rotation results from Doppler velocity measurements made at Mount Wilson over a period of more than 14 years. Altogether data from 188 rotations are presented. These results are displayed in various tables and figures. Measurements of scattered light along with its effect on the measured rotation rate are shown. (12 refs.)

69585 Relationships between photospheric plasma angular velocity and solar activity. G.Godoli (Cattedra di Fisica Solare, Univ. di Firenze, Firenze, Italy), F.Mazzucconi.
Sol. Phys. (Netherlands), vol.83, no.2, p.339-47 (March 1983).
An analysis of relationships between latitudinal fine structures of the photospheric plasma differential rotation and solar activity shows that sunspot activity seems to be lower (as measured by the number and extension of sunspot groups) at latitudes where minima of angular velocity appear. (7 refs.)

69586 First results from the Clark Lake Multifrequency Radioheliograph [coronal images]. M.R.Kundu, W.C.Erickson, T.E.Gergely, M.J.Mahoney, P.J.Turner (Clark Lake Radio Obs., Univ. of Maryland, College Park, MD, USA).
Sol. Phys. (Netherlands), vol.83, no.2, p.385-9 (March 1983).
Gives a brief description of the Clark Lake Multifrequency Radioheliograph which is being used for solar research in the frequency range 20-125 MHz. The authors present two-dimensional images of the Sun's corona at several frequencies within this range, obtained with time resolution as good as 1.28 s. The shape of the Sun's outer corona as observed at meter-decameter wavelengths appear to change in time periods as short as a few seconds. (5 refs.)

69587 Coronal disturbances and their terrestrial effects. D.M.Rust (American Sci. & Engng. Inc., Cambridge, MA, USA).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.21-36 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Coronal disturbances lead to geomagnetic storms, proton showers, auroras and a wide variety of other phenomena at Earth. Yet, attempts to link interplanetary and terrestrial phenomena to specific varieties of coronal disturbances have achieved only limited success. Here, several recent approaches to prediction of interplanetary consequences of coronal disturbances are reviewed. The relationships of shocks and energetic particles to coronal transients, of proton events to γ-ray bursts, of proton events to microwave bursts, of geomagnetic storms to filament eruptions and of solar wind speed increases to the flare site magnetic field direction are explored. A new phenomenon, transient coronal holes, is discussed. These voids in the corona appear astride the long decay enhancements (LDEs) of 2-50 Å X-ray emission that follow Hα filament eruptions. The transient holes are similar to long-lived coronal holes, which are the sources of high speed solar wind streams. There is some evidence that transient coronal holes are associated with transient solar wind speed increases. (52 refs.)

69588 Plasma-physical aspects of the solar cycle. M.A.Raadu (Dept. of Plasma Phys., Royal Inst. of Technol., Stockholm, Sweden).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.37-45 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Mass motions below the photosphere drive the solar cycle which is associated with variations in the magnetic field structure and accompanying phenomena. In addition to semi-empirical models, dynamo theories have been used to explain the solar cycle. The emergence of magnetic field generated by these mechanisms and its expansion into the corona involves many plasma physical processes. Magnetic buoyancy aids the expulsion of magnetic flux. The corona may respond dynamically or by continually adjusting to a quasi-static force-free or pressure-balanced equilibrium. The formation and disruption of current sheets is significant for the overall structure of the coronal magnetic field and the physics of quiescent prominences. The corona has a fine structure consisting of magnetic loops. The structure and stability of these are important as they are one of the underlying elements which make up the corona. (88 refs.)

69589 Electrodynamics of the outer solar atmosphere. M.Kuperus (Astron. Inst., Univ. of Utrecht, Utrecht, Netherlands).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.47-54 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
The structure of the outer solar atmosphere and its magnetic coupling to the photospheric motions indicate the existence of large-scale current systems. The heating and the dynamics of coronal structures is therefore governed by electrodynamic coupling of these structures to the underlying photosphere. In a structured corona, the heating is enhanced because of several processes such as resonance absorption of Alfvenic surface waves, anomalous Joule heating, reconnection and the related topological dissipation. The global thermal and dynamic behaviour of coronal structures can be fruitfully described, in terms of equivalent electrodynamic circuits, taking into account the paramount role of the photospheric boundaries. Coronal current systems may be stable, as in the case of coronal loops, but occasionally they show catastrophic behaviour if the current intensity surpasses a critical threshold. (33 refs.)

69590 Dynamics of the preflare magnetic field. J.W.Harvey (Kitt Peak Nat. Obs., Tucson, AZ, USA).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.55-62 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Many theories of the solar flare process invoke storage of energy in the active region magnetic field above the solar photosphere. Observational evidence relating to such storage is rather unsatisfactory owing to the difficulty in observing the three-dimensional structure of the magnetic field. Indirect evidence comes from changes in structures presumed to trace the magnetic field, from changes in the line-of-sight and transverse components of the photospheric magnetic field, from mass flow patterns observed by proper motions and line-of-sight Doppler shifts, and from radio observations. These data tend to confirm that energy sufficient to produce flares can be stored in active region magnetic fields with a characteristic time scale of hours but critical observations are not yet available. (66 refs.)

69591 Solar wind theory. S.Cuperman (Dept. of Phys. & Astron., Tel Aviv Univ., Ramat Aviv, Israel).
Space Sci. Rev. (Netherlands), vol.34, no.1, p.63-72 (Jan. 1983). (Fifth International Symposium on Solar-Terrestrial Physics, Ottawa, Canada, 17-22 May 1982).
Some advances in the hydrodynamical large-scale theory, on the one hand, and in the kinetic theory, on the other hand, of the solar wind are reviewed.

For brevity, the author sketches the general frame, points out the problems and approaches and then illustrates by a few example the ways in which progress has been achieved during the past four years. (32 refs.)

69592 Intermediate drift bursts. O.Elgaroy.
Report 53, Univ. Oslo, Blindern, Norway (1982), 30 pp.
Different parameters which are characteristic of intermediate drift bursts are determined from observations undertaken with high resolution radio spectrographs operating in four frequency bands between 150 and 1000 MHz. Data on frequency drift velocity, duration, bandwidth and frequency profile are given. The occurrence of bursts in groups is examined. Correlation is shown to exist between frequency drift velocity and observed bandwidth. The relation between observed and intrinisc values of bandwidth and duration is discussed, together with magnetic field strengths, which may be derived in different ways. (18 refs.)

Generation of lower hybrid waves by inhomogeneous electron streams .... See Entry 69443

Diffusion of low-energy electrons as a function of the position of outburst relative to the interplanetary current sheet .... See Entry 69454

Propagation of solar disturbances: theories and models .... See Entry 69468

Direct correlations between coronal transients and interplanetary disturbances .... See Entry 69469

Observations of interplanetary shocks: recent progress .... See Entry 69470

Dissipation of MHD waves in an inhomogeneous streaming plasma .... See Entry 69481

The pure rotation spectrum of the hydroxyl radical and the solar oxygen abundance .... See Entry 69493

Limitation imposed by strong Langmuir turbulence on the shelf-consistency of the quasi-linear dynamics .... See Entry 69496

Method of estimating Langmuir's turbulence in a solar flare .... See Entry 69509

On the origin and structure of stellar magnetic fields .... See Entry 69593

A model for the magnetic field above supergranules .... See Entry 69601

97.00 STARS

97.10 STELLAR CHARACTERISTICS

69593 On the origin and structure of stellar magnetic fields. J.H.Piddington (Div. of Appl. Phys., CSIRO, Sydney, Australia).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.217-30 (Feb. 1983).
Newly formed stars have magnetic fields provided by the compression of the interstellar field, and contrary to a widely accepted idea these fields are not destroyed by convective motions. For the same reason, the fallacy of 'turbulent diffusion', turbulent dynamo action is not possible in any star. Thus all stellar magnetic fields have a common origin, and persist throughout the lifetime of each star, including degenerate phases. This common origin, and a general similarity in stellar evolutionary processes, suggest that the fields may develop similar structural characteristics and MHD effects. The author considers three features of solar magnetic fields and their MHD effects. First, the solar magnetic field comprises two separate components: a poloidal field and a toroidal field. The former is a dipole field, permeating the entire Sun and closely aligned with the rotational axis; at the surface it is always concealed by much stronger elements of the toroidal field. The latter is probably wound from the former by differential rotation at latitudes below about 35°. The second feature of solar magnetic fields is that all flux is concentrated into flux tubes of strength some kG, isolated within a much larger volume of non-magnetic plasma. The third feature is that the flux tubes are helically twisted into flux ropes (up to $\gtrsim 10^{22}$ Mx) and smaller elements ranging down to flux fibres ($\lesssim 10^{18}$ Mx). Some implications of similar features in other stars are discussed. (39 refs.)

69594 Hydrogen sulfide in a circumstellar envelope. N.Ukita (Inst. de Radio Astron. Millimetrique, Domaine Univ. de Grenoble, Saint-Martin d'Heres, France), M.Morris.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.15-18 (May 1983).
A search for hydrogen sulfide in the cool circumstellar envelopes of 25 stars was made using the 1_{10}-1_{01} rotational line at 1.8 mm. It was detected in the bipolar nebula/OH maser OH 231.8+4.2, an object having a high rate of mass loss. An approximate analysis indicates that 1/60 of the sulfur in this outflowing envelope is in the form of H_2S, a fraction which may be similar to that in the atmosphere of the central star. In addition, the shape of the observed line profile is discussed in terms of a possible variation of the outflow velocity with latitude above the system's equatorial plane. (20 refs.)

69595 Numerical simulation of radiative transfer in circumstellar dust shells. II. Ellipsoidal shells. J.Lefevre (Obs. de Nice, Nice, France), J.-Y.Daniel, J.Bergeat.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.51-8 (May 1983).
For pt.I see ibid., vol.114, no.2, p.341-6 (1982). A numerical method is used to solve the radiative transfer problem. Multiple scattering, anisotropic phase functions and grain thermal emission are fully considered. This solution is an extension of the algorithm proposed by the authors for spherical shells. Dust grains are assumed spherical in shape and the Mie theory is adopted. The study is devoted to shells with uniform dust distribution. The computation gives the distribution of dust temperatures versus (r, θ) sperical coordinates, the spectral distribution of the outward net flux, the bidimensional images of the source at selected wavelengths for various values of the foreshortening angle (α) which specifies the observer's location. (9 refs.)

69596 On the influence of the 'α-turbulence' on the energy transport in accretion disks. W.J.Duschl (Inst. fur Astrophys., Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.153-4 (May 1983).
In the standard 'α-theory' for thin accretion disks [Shakura and Sunyaev (1973), Lightman (1974), and many others; for recent reviews see Pringle (1981) and Verbunt (1982)] the non-molecular viscosity is described by the ratio α of the viscous stress to the pressure. This viscous stress is usually thought to be caused by hydrodynamic or hydromagnetic turbulence. While the viscosity is taken to cause all the luminosity, the effect of such turbulence on the energy transport is not taken into account. It is shown that in radiatively structured disks the assumed turbulence contributes only less than one percent of the whole energy flux. (11 refs.)

69597 Possible evidence for the driving of the winds of hot stars by Alfven waves. A.B.Underhill (Lab. for Astron. & Solar Phys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L127-30 (15 May 1983).
Ultraviolet spectra of the supergiants α Cam (0.95 Ia), HD 105056 (ON9.7 Iae), and 15 Sgr (O0.7 Iab) are compared, and it is shown that the terminal outflow velocity, v_∞, of HD 105056 is one-half that of the other two stars even though HD 105056 has the highest effective temperature of the three stars. This anomaly, together with the fact that the observed v_∞ values for early-type stars scatter about an empirical correlation between v_∞ and log T_{eff} by an amount which is larger than the amount expected according to the observational errors in determining v_∞ and log T_{eff}, leads to the conclusion that an agent in addition to radiation, Alfven waves, is driving the winds of early-type stars. (23 refs.)

69598 Dynamical constraints on star formation efficiency. R.D.Mathieu (Dept. of Astron., Univ. of California, Berkeley, CA, USA).
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L97-101 (15 April 1983).
Dynamical constraints are placed on the local star formation efficiency during the formation of star clusters. Virial models are used to examine the expected changes in cluster velocity dispersion, density, and radius during the period when the gas not converted into stars is removed from the system. Comparison of observed initial and final states of open clusters indicate local efficiencies of about 30% if the gas dispersal is slow relative to the dynamical crossing time and 55% if the gas loss is rapid. Efficiencies are somewhat dependent on support mechanisms of molecular clouds, but it is argued that observations of young clusters are in accord with the assumptions of the models used here. (24 refs.)

69599 The influence of waves on line formation in stellar atmospheres. J.Stahlberg (Zentralinst. fur Astrophys., Akad. der Wisseuschaften, Potsdam, Germany).
Astron. Nachr. (Germany), vol.304, no.1, p.49-53 (1983).
The influence of acoustic waves on line formation is investigated. The effects of velocity model parameters, e.g. wave number and amplitude, and of the μ-dependence on line formation are discussed by simplified model assumptions. The effects of waves and Gaussian stochastic turbulence are compared. (10 refs.)

69600 Atomic and molecular hydrogen in the circumstellar envelopes of late-type stars. A.E.Glasscold, P.J.Huggins (Dept. of Phys., New York Univ., New York, NY, USA).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.517-32 (May 1983).
Discusses the distribution of atomic and molecular hydrogen in the expanding circumstellar envelopes of cool evolved stars. The main concern is to evaluate the effects of photodestruction of H_2 by galactic UV radiation, including shielding of the radiation by H_2 itself and by dust in the envelope. One of the most important parameters is the H/H_2 ratio which is frozen out in the upper atmosphere of the star. For stars with photospheric temperatures $T_* \gtrsim 2500$K, atmospheric models suggest that the outflowing hydrogen is mainly atomic, whereas cooler stars should be substantially molecular. In the latter case, photodissociation of H_2 and heavy molecules contribute to the atomic hydrogen content of the outer envelope. The estimates indicate that atomic hydrogen is almost at the limit of detection in the C-rich star IRC+10216, and may be detectable in warmer stars. (39 refs.)

69601 A model for the magnetic field above supergranules. U.Anzer, D.J.Galloway (Max-Planck-Inst. fur Astrophys., Garching, Munchen, Germany).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.637-50 (May 1983).
A model is provided for the inhomogeneous magnetic field structure above a stellar photosphere where the field is concentrated in intense tubes at the downflow regions of a convection pattern. By finding where the magnetic energy is strong or weak compared with the local thermal energy of the gas, the relative importance of magnetic and non-magnetic heating mechanisms can be estimated for those regions where the principal radiative losses occur in solar or stellar chromospheres. (31 refs.)

69602 Stellar reaction rate of ^{20}Ne(α,γ)^{24}Mg. P.Schmalbrock, H.W.Becker, L.Buchmann, J.Gorres, K.U.Kettner, W.E.Kieser, H.Krawinkel, C.Rolfs, H.P.Trautvetter (Inst. fur Kernphys., Univ. Munster, Munster, Germany), J.W.Hammer, R.E.Azuma.
Nucl. Phys. A (Netherlands), vol.A398, no.2, p.279-307 (25 April 1983).
The reaction ^{20}Ne(α,γ)^{24}Mg has been investigated at E_α(lab)=0.55-3.20 MeV. Neon gas enriched to 99.95% in ^{20}Ne was recirculated in differentially pumped gas target systems of the extended and quasipoint jet types. New resonances were found at E_α(lab)=958, 1226, 1260, 1704 and 2277 keV, which correspond to known states in ^{24}Mg. Excitation energies, γ-ray decay schemes, γ-ray angular distributions, resonance widths and strengths as well as J^π and T-assignments are reported for all the resonances. Information on low-lying states in ^{24}Mg is also obtained. The nuclear and astrophysical aspects of the results are discussed. (37 refs.)

69603 Distant anticenter A-F stars and the galactic abundance gradient. C.A.Christian (Canada-France-Hawaii Telescope Corp., Kamuela, HI, USA), H.A.Smith.
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.169-80 (March 1983).
Spectrophotometry was obtained for 16 objects suspected of being highly reddened A-F stars, located in a galactic anticenter field at $l=186°$ and $b=-2.5°$. The stars have been classified according to spectral type. Two of them appear to be luminous F-type stars having large galactocentric distances (12-30 kpc). These two stars are moderately metal poor, consistent with an abundance gradient in the galactic disks of $d[\mathrm{Fe/H}]dR=-0.08\pm0.04$ kpc^{-1}. Supplementary photographic image-tube spectrograms were used as comparisons in the determination of stellar calcium abundances. (29 refs.)

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97.20 NORMAL STARS (BY CLASS): GENERAL OR INDIVIDUAL

69604 The Mg II h and k lines in Vega. R.Freire Ferrero (Obs. Astron., Strasbourg, France), P.Gouttebroze, Y.Kondo.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.59-68 (May 1983).
High resolution h (2802.7 Å) and k (2795.5 Å) lines Mg II obtained for the star Vega (α Lyr, A0V) with Copernicus satellite and a balloon-borne ultraviolet stellar spectrometer (BUSS) are interpreted by means of theoretical NLTE line profiles in the frame work of complete (CR) and partial (PR) redistribution hypothesis. LTE and NLTE atmospheric models with a temperature plateau or with temperature rises are used to account for the possible presence of a chromosphere on Vega. The authors discuss also the possible presence of an interstellar Mg II absorption line superimposed on the stellar ones. (52 refs.)

69605 The upper mass limit for white dwarf progenitors and the initial-final mass relation for low and intermediate mass stars. V.Weidemann, D.Koester (Inst. fur Theoretische Phys. und Sternwarte, Univ. Kiel, Kiel, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.77-84 (May 1983).
New results on white dwarfs in open clusters which establish an upper mass limit of white dwarf progenitors around $8M_\odot$ have been evaluated for the construction of a semi-empirical initial-final mass relation for stellar evolution in the low and intermediate mass range. The new M_f/M_i-relation explains the fact that the vast majority of white dwarfs and nuclei of planetary nebulae have masses in a narrow range around $0.6M_\odot$. High mass remnants exist in both cases but are extremely rare. This is confirmed by model calculations of galactic evolution which are carried out with improved input data on IMF, stellar birthrates, and stellar dynamics, for different M_f/M_irelations. Constraints are thus provided for theoretical schemes of single star evolution with mass loss, dredge-up, and enrichment of the interstellar medium. (92 refs.)

69606 Non-LTE analysis of subluminous O-stars. V. The binary system HD 128220. J.Gruschinske, W.-R.Hamann, R.-P.Kudritzki, K.P.Simon, J.P.Kaufmann.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.85-90 (May 1983).
For pt.IV see ibid., vol.95, no.2, p.244-9 (1981). Spectra of the binary system HD 128220 were taken in the UV and in the visual. The hot component−an O subdwarf−is analysed by means of non-LTE calculations. The analysis is hampered because the visual spectrum is contaminated by the cool companion. Using the helium lines only, the atmospheric parameters can be restricted to the range between two models. The cool companion has an effective temperature about 5500±500K (Type G). The discussion of the stellar parameters arrives at results which agree with those derived from the mass function (Wallerstein and Wolff, 1966). If both components have about the same mass, these masses lie above 3 $M_\odot$. An O subdwarf of such a high mass has not yet been found and may be a supernova candidate. However, within the error margin of the orbital data also a mass ratio of $M_O/M_G=0.5$ cannot be excluded, which would lead to stellar parameters which are more common for sdO's. (22 refs.)

69607 Discovery of a nitrogen-rich UV-bright star in the globular cluster M5. R.C.Bohlin (Lab. for Astron. & Solar Phys., Goddard Space Flight Center, Greenbelt, MD, USA), R.H.Cornett, J.K.Hill, A.M.Smith, T.P.Stecher, A.V.Sweigart.
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L89-92 (15 April 1983).
Ultraviolet images of the globular cluster M5 (NGC 5904) obtained with a rocket-borne telescope show a hot and luminous star ~20″ from the cluster center. Spectra of this UV-bright star, obtained with the International Ultraviolet Explorer satellite in the low-resolution mode, reveal an energy distribution very similar to that of μ Col, a Population I O9.5 IV star with $T_{eff}=35000K$ and log $g=4.19$, except for the absence of metallic line blanketing. Assuming an effective temperature of 35000K for the UV-bright star, the authors find $L=1800$ $L_\odot$, $M_{bol}=-3.40$, $R=1.15$ $R_\odot$, and log $g=4.04$. The N V $\lambda 1240$ line is much stronger in the UV-bright star than in μ Col, indicating that the CNO cycle has converted the envelope C and O into N. A single emission line at the wavelength of the N IV intercombination line is also present, suggesting the possible existence of a planetary nebula. The mass-luminosity relation for asymptotic giant branch stars gives $M=0.53$ $M_\odot$, implying a mass loss of 0.08 $M_\odot$ since the horizontal-branch phase. (30 refs.)

69608 Measurement of the absolute monochromatic flux from Vega at $\lambda 2.20$ and $\lambda 3.80$ μm by comparison with a furnace. M.J.Selby, C.M.Mountain (Blackett Lab., Imperial Coll. of Sci. & Technol., London, England), D.E.Blackwell, A.D.Petford, S.K.Leggett.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.795-800 (May 1983).
A determination has been made using the 1.5-m flux collector at Tenerife of the absolute monochromatic flux from Vega at 2.20 and 3.80 μm by comparison with the flux from a furnace which has been calibrated against a standard blackbody at a known temperature. The technique used is an improvement on one previously used by the authors at Tenerife in 1979. The fluxes found are 3.92×10^{-10} W m^{-2} μm^{-1} at 2.20 μm, and 5.28×10^{-11} W m^{-2} μm^{-1} at 3.80 μm, each with an accuracy of about 4 per cent. Comparison is made with other calibrations and with calculated fluxes. The agreement with other calibrations is good, but comparison with the flux calculations of Dreiling and Bell (1980) for their model shows an observed excess flux of 8 per

cent at 3.80 μm. Suggestions are made to account for this excess. An empirical flux distribution over the wavelength range 1 $\mu m<\lambda<4$ μm is proposed with a likely accuracy of 3 per cent. (16 refs.)

69609 Stellar rotation as a controller of coronae and chromospheres of giant stars. D.F.Gray (Univ. of Western Ontario, London, Ontario, Canada).
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.181-4 (March 1983).
The flux of X-ray emission from F, G, and K giants drops abruptly at G5 III. This mimics the drop in rotation rates of giants seen previously. The X-ray flux, when normalized to the bolometric flux, varies as the square of the equatorial surface rotation velocity. Lines formed in the chromospheric and transition region do not show such a close relationship with rotation, but are still correlated with it. Other H-R-diagram boundaries, such as the one for the V/R ratio for the Ca II K-line emission, appear not to be directly coupled to the stellar rotation. (35 refs.)

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Photoelectric observations of TY Del ......See Entry 69662

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Observations of the RS CVn star HD 26337 with the International Ultraviolet Explorer satellite ......See Entry 69664

The thirty-two year cycle in Algol ......See Entry 69665

A photoelectric light curve of AH Cephei ......See Entry 69666

LMC X-1: another massive binary? ......See Entry 69669

The enigmatic composite system HD 45166−B8 V+qWR or SdO? ......See Entry 69671

Optical and IR light curves of VV Puppis ......See Entry 69673

Color-magnitude photometry of 47 Tucanae to $M_V=+9$ ......See Entry 69680

New polarisation measurements of HD 183143, HD 204827, and Cyg OB 2 Sch. No.12 ......See Entry 69691

High-density gas associated with 'molecular jets': NGC 1333 and NGC 2071 ......See Entry 69695

Three-micron spectrometry in Sharpless 106 ......See Entry 69698

Detection of H_2 emission in Herbig-Haro object No.101 ......See Entry 69703

Emission-line profiles for selected planetary nebulae and symbiotic stars, V1016 Cygni, and HM Sagittae ......See Entry 69707

VLA observations of massive star formation in spiral nuclei ...See Entry 69721

Stellar statistical analysis in the neighbourhood of the Sun .....See Entry 69725

High spatial resolution VLA observations of the R Aquarii jet ......See Entry 69742

97.30 VARIABLE AND PECULIAR STARS

(inc. novae)

69610 A reanalysis of the data of three classical Cepheids: V381 Cen, V500 Sco, and SV Vel. G.Russo (Capodimonte Astron. Obs., Naples, Italy).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.147-51 (Feb. 1983).
Using the recently developed CORS method, applied to the photometric data of Walraven et al. (1964), the author has determined improved radii for the three classical Cepheids V381 Cen, V500 Sco, and SV Vel. These new determinations are in good agreement with theoretical computations for the center of the instability strip (Cogan, 1978). Some peculiar parameters are also computed, from the analysis of photometric data. (13 refs.)

69611 The influence of magnetic fields on nova outbursts. M.Livio (Dept. of Phys., Technion-Israel Inst. of Technol., Haifa, Israel).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.L7-10 (May 1983).
Magnetic fields were found to play an important role in many cataclysmic variables. The effects of a magnetic field on nova outbursts are examined. It is found that magnetic field strengths above a certain limit can inhibit nova explosions. This can explain why active novae are absent among AM Her objects, while novae can be found among intermediate polars. (29 refs.)

69612 A model for the standstill of the Z Camelopardalis variables. F.Meyer, E.Meyer-Hofmeister (Inst. fur Astrophys., Max-Planck-Inst. fur Phys. und Astrophys., Garching, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.29-34 (May 1983).
Recent models relate the outbursts of dwarf novae to convective outer regions of accretion disks around the primary white dwarf. Such regions disappear for accretion rates above a critical value $\dot{M}_{crit}$. By means of disk structure computations the authors show that the accretion rate in Z Cam is near $\dot{M}_{crit}$. The authors suggest that in standstills it is slightly higher than this value while in the cyclic phase it is slightly lower. This is explained as an effect of irradiation of the secondary's surface producing higher mass overflow rates in steady standstills than in cyclic phases and enabling the system to remain in either state. In the long run an imbalance between the mean accretion rate $\dot{M}_0$ and the actual accretion rate in either state forces the system to alternate between its two states in form of a relaxation oscillation. With this model the Z Cam system fall between the U Gem subgroup and the UX Uma subgroup. Observational evidence for the model is discussed. (26 refs.)

69613 Properties of Am, δ Del, and δ Sct stars in the VBLUW system. M.J.J.Wiertz, A.M.van Genderen (Leiden Obs., Leiden, Netherlands).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.35-41 (May 1983).
VBLUW photometric observations of 115 Am, δ Del, and δ Sct stars are presented and discussed. The spread with respect to the main sequence in the two-colour diagrams is discussed. The temperatures derived by Babu and Shylaja (1981, 1982) and based on spectral energy distribution, reveal that the photometric temperatures are underestimated. This is caused by line blanketing on the colour indices $b-y$ and $V-B$, of which the size as a function of the temperature can be roughly estimated. The relation between the temperature sensitive colour indices $V-B$ (of the VBLUW system), $b-y$ ($ubvy\beta$ system) and B_2-V_1 (Geneva system) for A/F type stars is investigated. A PLC relation for the colour $V-B$ is derived using Breger's (1979) relation for the colour $b-y$. (30 refs.)

69614 An observational study of the influence of close companions on the pulsations of β Cephei stars. C.Waelkens (Obs. de Geneve, Sauverny, Switzerland), F.Rufener.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.45-50 (May 1983).
The evidence for short-period pulsations of seventeen close binary stars that fall in the zone of the HR diagram defined by the β Cephei stars is discussed. The only star in the sample for which the authors detected pulsations is η Orionis; its orbital period is about twice that of α Virginis. It is suggested that the tidal interactions have a damping effect on β Cephei type pulsations. This would explain why the observed lower limit of the orbital periods of the binary β Cephei stars is about three times the theoretical lower limit, which corresponds to a contact configuration. It is also suggested that tidal effects are responsible for the variations of the pulsation amplitudes of the three β Cephei stars with shortest known orbital periods: α Virginis, β Cephei and 16 Lacertae. (48 refs.)

69615 On the variability of RZ Cephei. Z.Glownia (Inst. of Phys., Silesian Univ., Katowice, Poland).
Astron. Nachr. (Germany), vol.304, no.1, p.45-8 (1983).
A long series of photoelectric observations of RZ Cep is analysed by two independent methods. The derived period is in good agreement with the suspected lengthening of the period. The secondary variability seems to be spurious. (9 refs.)

69616 Commission 27 of the IAU information bulletin on variable stars. J.Horn, R.Hudec, P.Koubsky (Astron. Inst., Czechoslovak Acad. of Sci., Prague, Czechoslovakia).
Inf. Bull. Variable Stars (Hungary), no.2304, p.1-2 (30 March 1983).
The authors report photometric data for the Be star V1294 Aquilae (=HD 184279 =MWC 319) derived from blue-sensitive photographic plates taken in the period 1929 to 1980. The estimated photographic magnitudes were analysed for possible periods; a reasonable fit was obtained for periods of about 2800 to 3000 days, but no strict long-term periodicity was found. The correlation between photometric and spectral variations is discussed: the current shell episode (which has lasted for more than 4000 days) and a previous prolonged shell episode from JD 2425000 to 2430000 were accompanied by profound and complex light variations, whereas a short-lived shell episode around JD 2432000 passed without any unusual light variations. (1 ref.)

69617 On the short time scale period of α Cir. H.Schneider (Univ. of Gottingen, Gottingen, Germany), W.W.Weiss.
Inf. Bull. Variable Stars (Hungary), no.2306, p.1-2 (5 April 1983).
The authors report VBLUW photometry of the rapidly oscillating Ap star α Circini (HD 128898) on the night of 1982 July 23 to 24. Light variations with a period of 6.834±0.01 minutes and an amplitude of about 0.01 mag. were observed. The amplitude of pulsation seems to be variable; this variability may allow an independent determination of the rotation period and may set limits on i and β. (4 refs.)

69618 New research on periods of Ap stars observed at ESO. VII. J.Manfroid, P.Renson (Inst. d'Astrophys., Univ. de Liege, Liege, Belgium).
Inf. Bull. Variable Stars (Hungary), no.2311, p.1-2 (12 April 1983).
For pt.VI see I.B.V.S., No. 2004 (1981). The authors report periods and amplitudes of variations for seven Ap stars from uvby photometry during September 1981 and January 1982. The stars observed, with their periods, are HD 208217 (8.35^d), HD 10840 (2.100^d), HD 45530 (1.585^d), HD 58292 (2.95^d or 1.484^d), HD 58448 (0.831^d), HD 64972 (0.727^d?) and HD 66698 (4.12^d). Observations of small amplitude variations in α Sculptoris (HD 5737) and HD 189832, with periods of about 15 days and 16 days respectively are also reported. Four other Ap stars (74 Aquarii, 29 Piscium, HR 151 and HR 444) showed no detectable variations; HR 11 showed small amplitude variations, but the period could not be determined. Finally it is reported that five comparison stars (HR 8369, 70 Aquarii, HD 224639, HD 45431 and HR 2944) have been found to be variable. (no refs.)

69619 Radial velocity variation of the Be star 6 Cep (HD 203467). Z.T.Krajeeva (Dept. of Astron., Bulgarian Acad. of Sci., Sofia, Bulgaria), P.Koubsky.
Inf. Bull. Variable Stars (Hungary), no.2313, p.1-3 (18 April 1983).
The authors report an analysis of the radial velocity variations of the Be star 6 Cephei, using 80 measured radial velocities. Owing to the inhomogeneity of the data, two files of data were formed: the first (file A) contains all 80 measurements, whereas the second (file B) contains only the 51 most reliable measurements. The data of file A yield a radial velocity variation with $P=2.438942^d$, K=7.0 kmbs, whereas those of file B yield $P=0.708469^d$, K=9.0 kmbs. The results are consistent with the hypothesis that 6 Cephei is a binary star with an unseen companion of mass 0.5 $M_\odot$ (file A) or 0.4 $M_\odot$ (file B); however, it is pointed out that the 0.7^d period is close to the rotational period of the star. (9 refs.)

69620 Differential UBV-photometry of the chemically peculiar star HD 135297. H.M.Maitzen (Inst. fur Astron., Univ. Klien, Klien, Austria).
Inf. Bull. Variable Stars (Hungary), no.2324, p.1-2 (29 April 1983).
The author reports UBV photometry of the magnetic Ap star HD 135297 on twelve nights covering the period 1970 May 6 to June 16. The standard deviations of the measurements in the three colours are σ(U)=0.0105, σ(B)=0.0063 and σ(V)=0.0048. There is a weak indication that the U-values show a periodicity of about 3 days. In addition the author analyses the results of Stromgren photometry of HD 135297 during the period 1974 March 25 to April 2; the results are in good agreement with UBV photometry, and it is concluded that there is only marginal evidence for light variations in this star. (2 refs.)

69621 BD+37°443: a new red variable star. M.Lolli, L.Oculi, A.Piccioni, R.Serra (Dipartimento di Astron., Univ. di Bologna, Bologna, Italy).
Inf. Bull. Variable Stars (Hungary), no.2325, p.1 (2 May 1983).
It is reported that BD+37°443 (KO III), which was used by Bartolini et al. (1982) as a comparison star for the O-type subdwarf BD+37°442, is variable. According to the BD catalogue and the AGK2 catalogue, BD+37°443 is brighter than BD+37°442, but in 1977 BD+37°443 was much the fainter star. BV photometry of the two stars between November 6 and December 17, 1977, and on 1983 January 6 is reported: during 1977, BD+37°443 was fainter than BD+37°442 by about $\Delta V=0.6$ mag., but in January 1983 BD+37°443 was the brighter star by $\Delta V=0.29$ mag. The amplitude of the light variation of BD+37°443 is at least 0.9 mag. in V and 0.7 mag. in V. BD+37°443 may therefore be a long period variable star or a semiregular variable. (5 refs.)

69622 Spurious periods and the case of EL Comae Berenices. J.Wheatley (Maria Mitchell Obs., Nantucket, MA, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.17-20 (1982).
An average period of 0.52285 day was calculated from 1978-81 observations of EL Comae Berenices. A 0.343 day period preferred by previous observers is rejected as spurious. EL Comae Berenices exhibits irregular light variations which prevent easy distinction between the two periods. (5 refs.)

69623 Does S1910 vary?. D.Hoffleit (Yale Univ. Obs., New Haven, CT, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.25-6 (1982).
A star suspected of variability by A.J. Cannon in 1899, S1910, at $\alpha=12^h 36.2^m$, $\delta=-59°\ 08'$ (1900), and still unconfirmed, has been examined on about 1000 Harvard patrol plates. it appears to vary from magnitude 4.9 to about magnitude 5.7. (no refs.)

69624 The decreasing periods of R Aquilae and R Hydrae. M.S.Davis (Dept. of Astron., Villanova Univ., Villanova, PA, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.27-34 (1982).
Times of maximum light of the long period variables R Aquilae and R Hydrae have been fitted to parabolic elements corresponding to constantly decreasing periods. The fit is satisfactory for R Aquilae but not for R Hydrae. (10 refs.)

69625 Photometry of Betelgeuse from October 1981 to March 1982. K.L.Krisciunas (UK Infrared Telescope, Hilo, HI, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.37-40 (1982).
Observations of Betelgeuse in V and B−V from October 1981 to March 1982 are presented, showing variations of brightness and color. Three seasons of observations are summarized. The possible origin of the variations is briefly discussed. (4 refs.)

69626 SU Tauri. C.E.Spratt, J.Bortle.
I.A.U. Circ. (USA), no.3791, 1 pp. (14 April 1983).
Visual magnitude estimates are reported for the R Coronae Borealis star SU Tauri, covering the period 1983 March 5 to April 6. During this time the star faded from mag. 12.2 to mag. 13.1. (no refs.)

69627 11 Camelopardalis. L.Pastori.
I.A.U. Circ. (USA), no.3795, 1 pp. (29 April 1983).
It is reported that spectroscopic observations of the extreme Be star 11 Camelopardalis on 1982 December 13 and 29 show the appearance of emission features in the Balmer lines up to H12. Moreover the Fe II emission lines at 454.95 and 458.38 nm show an increase in intensity and have become clearly discernible. This behaviour is similar to that observed during the outbursts of 1916-19, 1929-31 and 1943-49; thus it seems that the star has commenced a new active phase. (no refs.)

69628 Transient X-ray rings around dwarf novae. G.Norwell, A.Evans, M.F.Bode (Dept. of Phys., Univ. of Keele, Keele, England).
Nature (GB), vol.303, no.5912, p.49-50 (5 May 1983).
The possibility that point X-ray sources possess extended haloes arising from scattering of X-rays by interstellar grains has been discussed by several authors and recent observations using the Einstein X-ray satellite have suggested that observational evidence for such haloes is now becoming available. Much of the theoretical work on such haloes to date has involved steady (time-independent) X-ray sources. While haloes around such sources can provide useful information about the scattering medium, variable X-ray sources are potentially much more powerful probes of the interstellar dust distribution. The authors discuss the scattering of soft X-rays emitted by dwarf novae in outburst, during which these objects undergo short (~1 day) eruption at soft X-ray wavelengths. The authors also consider the nature of the apparently transient soft X-ray 'ring' around the dwarf nova SU UMa and show that the properties of such a ring are consistent with those expected from the effect under consideration. (12 refs.)

69629 Detailed photometry of the Cepheid AD Geminorum. L.P.Connolly (Dept. of Phys., Simon Fraser Univ., Burnaby, BC, Canada), L.H.Palmer, B.D.Goodrich, W.Halbedel, J.L.Africano, G.W.Henry.
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.192-5 (March 1983).
A detailed light curve for AD Vem in G and $(b-y)$ is presented. The results of these observations are used in planning the requirements of a major observing program. (2 refs.)

69630 Identification of Lanning 90 as a previously uncataloged cataclysmic variable. A.W.Shafter (Dept. of Astron., Univ. of California, Los Angeles, CA, USA), H.H.Lanning, R.K.Ulrich.
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.206-10 (March 1983).
Presents spectroscopic observations which reveal Lanning 90 to be a previously uncataloged cataclysmic variable. Low-resolution spectra of the object display strong and broad emission lines of hydrogen and neutral helium superimposed on a continuum with roughly constant F_λ. In addition to the Balmer and He I emission lines, the spectrum shows high excitation lines of He II, C II, C III, and N III. After a brief discussion of its general spectral character the authors argue that Lanning 90 is probably a nova-like variable, the authors note that the photometric and spectroscopic variability exhibited by the object is similar to the variability shown by the AM Herculis systems. (21 refs.)

69631 ANS ultraviolet observations of dwarf Cepheids. C.R.Sturch, C.C.Wu (Computer Sci. Corp., Silver Spring, MD, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.211-16 (March 1983).
Ultraviolet observations of three dwarf Cepheids (VZ Cnc, SX Phe, and AI Vel) are presented. The UV light curves are consistent with those in the visual region. When compared to standard stars, all three dwarf Cepheids exhibit flux deficiencies at the shortest observed wavelengths. The most extreme deficiencies appear for SX Phe; these may be related to the other properties previously noted for this star, including low metallicity, high space motion, and low luminosity. (24 refs.)

Five years of photometry of λ Andromedae .... See Entry 69649

The magnetic field on the RS Canum Venaticorum star lambda Andromedae .... See Entry 69654

X-ray evidence for white dwarf binaries in globular clusters ... See Entry 69655

Extreme surface activity on the cool component of the eclipsing binary FF Aquarii .... See Entry 69658

1980 light curve of II Pegasi .... See Entry 69659

1981 light curve of II Pegasi .... See Entry 69660

1981-82 light curve of II Pegasi .... See Entry 69661

Observations of the RS CVn star HD 26337 with the International Ultraviolet Explorer satellite .... See Entry 69664

AW Sagittarii—a neglected variable .... See Entry 69667

The enigmatic composite system HD 45166—B8 V+qWR or SdO? .... See Entry 69671

Optical and IR light curves of VV Puppis .... See Entry 69673

Emission-line profiles for selected planetary nebulae and symbiotic stars, V1016 Cygni, and HM Sagittae .... See Entry 69707

High spatial resolution VLA observations of the R Aquarii jet .... See Entry 69742

97.60 LATE STAGES OF STELLAR EVOLUTION

(inc. black holes)

69632 Stellar collapses in the Galaxy. J.N.Bahcall (Inst. for Advanced Study, Princeton, NJ, USA), T.Piran.
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L77-81 (15 April 1983).
The expected rate of stellar deaths in the Galaxy (~0.1 per year) is computed using a detailed model of the distribution of stars in the disk and standard values for Population I stellar evolutionary lifetimes. Some of the uncertainties in this calculation are described. The sensitivities to stellar collapse of the existing gravitational wave and solar neutrino detectors are expressed in terms of convenient astrophysical variables and are found to be comparable for conventional choices of collapse parameters. The fraction of stars in the Galaxy that are accessible to a detector—of any kind of radiation (including X-ray or γ-ray satellites or ground-based telescopes)—that can survey out to a given distance is tabulated for different maximum distances and is shown to be important for interpreting the capabilities of existing detectors. The results of Davis provide the best available upper limit on the collapse rate. At least one order of magnitude improvement in the sensitivity of solar neutrino or gravitational wave detectors is necessary in order to detect galactic stellar collapses at the rate predicted by current models. (36 refs.)

97.60B Supernovae

69633 Lepton loss and entropy generation in stellar collapse. B.Datta (Indian Inst. of Astrophys., Bangalore, India), P.P.Deo.
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.109-15 (Feb. 1983).
The effects of uncertainties in determining the loss of neutrinos and the generation of entropy during the collapse of a stellar core are studied using a simple spherically-symmetric homologous collapse model with an improved treatment for the excited nuclei. It is found that the neutrino loss and entropy generation are not altogether insensitive to most variations of the assumptions regarding the input physics, collapse rate and initial conditions and in particular the need to determine accurately beta capture rates in stellar collapse is pointed out. (12 refs.)

69634 Supernova in ESO 270-G05. J.Maza.
I.A.U. Circ. (USA), no.3791, 1 pp. (14 April 1983).
The author reports the discovery on 1983 April 6 of a possible 18th-magnitude supernova 18″ west and 10″ south of the nucleus of the galaxy ESO 270-G05 ($\alpha=13^h 18.7^m$, $\delta=-45°40'$, equinox 1950.0), in Centaurus. (no refs.)

69635 Supernova in NGC 4753. W.Wamsteker, A.Talavera, F.Machetto, N.Panagia, G.G.C.Palumbo, A.Piccioni, G.Vettolani.
I.A.U. Circ. (USA), no.3791, 1 pp. (14 April 1983).
The authors report optical and ultraviolet observations of the supernova in NGC 4753 during April 1983. An ultraviolet spectrogram between 200 and 300 nm obtained by the IUE satellite shows a weak spectrum steeply decreasing towards shorter wavelengths, characteristic of a type I supernova. An optical spectrogram obtained on 1983 April 10 also shows the supernova to be a type I object, with prominent absorption at 615 nm. The fine-error-sensor magnitude measured by the IUE was 12.7, but this includes a contribution from NGC 4753 itself. The position of the supernova is $\alpha=12^h 49^m 47.4^s$, $\delta=-00°55'54''$ (equinox 1950.0). (no refs.)

69636 Supernova in NGC 4753. H.G.Corwin, E.P.Aksonov, T.Fetterman, C.Spratt.
I.A.U. Circ. (USA), no.3794, 1 pp. (29 April 1983).
Reports UBVRI photometry of the supernova in NGC 4753 on 14 and 16 April 1983. The colours and the rate of decline are consistent with those of type I supernovae 12 to 15 days past maximum. An independent discovery of the supernova on 1983 April 9 at $m_{pg}=13.4$ is reported, and visual magnitude estimates are given for the period 1983 April 11 to 17. (no refs.)

69637 PSR 1937+214. R.N.Manchester, B.A.Peterson, P.T.Wallace.
I.A.U. Circ. (USA), no.3795, 1 pp. (29 April 1983).
The authors report the detection of optical pulses at the 0.0016-s period of PSR 1937+214 (the millisecond pulsar') on 1983 April 20 and 21. The pulse profile has two components separated by about 40% of the period. The pulses were detected at the same phase on two consecutive nights using a 3.5″ aperture centred on a red star at $\alpha=19^h 37^m 28.70^s$, $\delta=+21°28'03.3''$ (equinox 1950.0, FK4 system); this is the candidate star suggested by Djorgovski (1982). The observed pulse variation is about 20% of the total light of the star. The star appears to be 2″ notch of the VLA radio position of the pulsar. The star is considerably brighter on a CCD image than on the Palomar Sky Survey red plate; the stellar spectrum does not exhibit strong emission lines. (2 refs.)

Observations of the interacting galaxy pair NGC 4490/85 ..... See Entry 69717

A variable radio source in the clumpy irregular galaxy Markarian 297 .... See Entry 69741

97.60G Pulsars

69638 Theory of NP 0532 pulsar radiation and the nature of the activity of the Crab Nebula. J.G.Lominadze, G.Z.Machabeli (Abastumani Astrophys. Obs., Acad. of Sci., Tbilisi, Georgian SSR), V.V.Usov.
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.19-43 (Feb. 1983).
Plasma processes in the magnetospheres of pulsars are considered. A self-consistent radiation model of the pulsar NP 0532 and the Crab Nebula is

presented. It is based on the consideration of cyclotron instability in a relativistic electron-positron plasma in a strong magnetic field. This instability onsets near the light cylinder of pulsar NP 0532. The pitch-angle and energy distribution of particles, caused by cyclotron instability development, is found. It is shown that the X- and γ-ray radiation of the pulsar is explained by the synchrotron radiation of beam particles. The scattering of excited oscillations on plasma particles is responsible for nonzero pitch-angles of the latter. As a result, synchrotron radiation originates which is within optical frequencies. The synchrotron luminosity evaluated coincides with that observed for NP 0532 in that spectral region. Cyclotron waves are pumped to lower frequencies due to nonlinear scattering by plasma particles and leave the pulsar magnetosphere as observable radio waves. The spectrum of ultra-relativistic electron-positron pairs ejected from the magnetosphere of the pulsar NP 0532 into the Crab Nebula is calculated. The expected spectrum of the synchrotron radiation of these particles in the Nebula agrees well with its observed spectrum at optical and X-ray frequencies. (53 refs.)

69639 Another millisecond pulsar. V.Boriakoff, R.Buccheri, F.Fauci.
I.A.U. Circ. (USA), no.3806, 1 pp. (11 May 1983).
The authors report the discovery of a millisecond binary radio pulsar at $\alpha=19^h\ 53^m\ 26.7^s$, $\delta=+29°00'42''$ (equinox 1950.0; VLA), inside the error box of the gamma-ray source 2C G065+1. The period and the period derivative on 1983 April 3.46 UT are $P=6.13369\pm0.000019$ ms and $\dot{P}<0.58\times10^{-15}$. The dispersion measure is 104.5 ± 0.3. The orbital elements of the binary system are $P=120\pm4$ days; $a \sin i=(0.92\pm0.08)\times10^7$ km; $e\sim0$. (no refs.)

69640 Fast pulsars with disks. F.C.Michel (Dept. of Space Phys. & Astron., Rice Univ., Houston, TX, USA), A.J.Dessler.
Nature (GB), vol.303, no.5912, p.48 (5 May 1983).
It is quite likely that fast pulsars are not rare; there are several point-like radio sources with pulsar-like radio spectra that might prove to pulse in the millisecond range. The possibility that the pulsar PSR 1937+214 is a new class of object has been considered by adherents of the vacuum model. The authors point out that the measured parameters of PSR 1937+214 are consistent with the proposed disk model of radio pulsars. Using the measured values of P and $\dot{P}$ and the scalings provided in this theory, the authors expect a surface magnetic field strength of $\sim10^8$ G, a radio-emission output of 10^{31} erg s^{-1}, and a weak (below detection with present instruments) output of energy in the X-ray and γ-ray ranges. The surface magnetic field cannot be checked, but the observed radio luminosity is 3×10^{30} erg s^{-1}, in agreement with the theoretical expectation of the disk model. (9 refs.)

Cosmic rays from binary neutron stars .... See Entry 69453

Extreme relativistic model for neutron stars and pulsars .... See Entry 69641

Torsional oscillations of neutron stars .... See Entry 69642

Relativistic conic sections .... See Entry 69668

97.60J Neutron stars

69641 Extreme relativistic model for neutron stars and pulsars. M.C.Durgapal, A.K.Pande, P.S.Rawat (Dept. of Phys., Kumaon Univ., Nainital, India).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.117-26 (Feb. 1983).
Exact solutions have been obtained for a massive fluid sphere under the extreme causality condition $(dP/d\rho)=1$. Radial pulsational stability of these structures has been discussed. It is found that for pulsationally stable configurations the surface to central density ratios is greater than 0.30, the maximum values for surface and central redshifts are 0.85 and 3.40 respectively in the extreme case, and the maximum mass and size are respectively 4.8 $M_\odot$ and 20.1 km. It has also been shown that these structures are gravitationally bound, with a maximum binding energy per unit rest mass equal to 0.25 for a surface to central density ratio $\simeq0.40$. Slow rotation of these configurations has also been considered, and the relative drag and moment of inertia have been calculated. These results have been applied to the Crab pulsar and the mass of the pulsar has also been calculated based upon this model. (28 refs.)

69642 Torsional oscillations of neutron stars. B.L.Schumaker (California Inst. of Technol., Pasadena, CA, USA), K.S.Thorne.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.457-89 (May 1983).
Motivated by the possibility that torsional oscillations of neutron stars may be observable in the timing of pulsar subpulses and/or in future gravitational-wave detectors, the authors develop the detailed mathematical theory of such torsional oscillations and of the gravitational waves they emit. The oscillations are then analysed using the formulation of first-order perturbations of a fully general relativistic spherical stellar model. The perturbations are resolved into spherical harmonics, which decouple from each other. For each harmonic the authors present equations of motion, an action principle, an energy conservation law and a Liapunov-type proof that the oscillations are always stable. Each harmonic is then resolved into normal modes with outgoing gravitational waves and an eigenvalue problem is posed for the eigenfunctions and the eigenfrequencies ω. Five methods of solving the eigenvalue problem are presented. (40 refs.)

Cosmic rays from binary neutron stars .... See Entry 69453

Relativistic paramagnetism .... See Entry 69491

Helium cyclotron emission from accreting magnetized neutron stars .... See Entry 69650

On the nature of two gamma bursts with spectral evolutions observed by the KONUS experiment .... See Entry 69752

97.60L Black holes

69643 Tidal compression of a star by a large black hole. I. Mechanical evolution and nuclear energy release by proton capture. B.Carter, J.-P.Luminet (Groupe d'Astrophys. Relativiste, Obs. de Paris, Meudon, France).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.97-113 (May 1983).
The gross qualitative behaviour of a star plunging deeply within the Roche tidal radius, R_R, of a large black hole to a pericentre radius $\beta^{-1}R_R$, with $\beta\gtrsim3$, is examined using a simplified affine star model whose evolution is canonically determined by a Lagrangian formalism. In Phase I, for $R\gtrsim R_R$, the star remains in only slightly distorted self-gravitating quasi-equilibrium, but in Phase II its particles undergo approximately free fall in the strong external tidal field within the Roche radius. In Phase III the compression is halted and reversed by the build-up of pressure in a highly flattened pancake configuration, in which adiabatic heating raises the temperature to a maximum. In Phase IV the matter expands again in approximately free fall, and in Phase V, as the star moves outside the Roche radius, pressure and self-gravitational forces again come into play. (23 refs.)

69644 The Hawking radiation of charged Dirac particles in Kerr-Newman spacetime. Xu Dian-Yan (Dept. of Computer Sci. & Technol., Peking Univ., Peking, China).
Acta Phys. Sin. (China), vol.32, no.2, p.225-38 (Feb. 1983). In Chinese. English translation in: *Chin. J. Phys. (USA)*
The Hawking radiation of charged Dirac particles on event horizon of Kerr-Newman black holes is studied. First the author constructs the symmetrized null tetrad from which the symmetrized spin coefficients and Dirac equation are derived. Next, he solves the Dirac equation near the event horizon and get the four component ingoing and outgoing wave functions. Finally, by analytic continuation, the Hawking thermal spectrum formula for Dirac particles for arbitrary Kerr-Newman black holes is obtained. (10 refs.)

69645 Stationary axially symmetric perturbations of the Reissner-Nordstrom black hole. L.Dvorak (Dept. of Didactics of Phys., Charles Univ., Praha, Czechoslovakia).
Czech. J. Phys. Sect. B (Czechoslovakia), vol.B33, no.4, p.377-88 (1983).
Interacting electromagnetic and gravitational perturbations of a charged nonrotating black hole are investigated in the stationary axisymmetric case. Linearized Einstein-Maxwell equations with sources decompose into four independent systems. Two of them can simply be solved analytically. From one of the remaining systems the pair of decoupled equations for the odd-parity gauge-invariant quantities of Moncrief (1974, 1975) is derived. (10 refs.)

69646 Potential black-hole candidates. N.E.White, F.E.Marshall.
I.A.U. Circ. (USA), no.3806, 1 pp. (11 May 1983).
It is reported that the HEAO-1 A2 all-sky X-ray spectral survey has revealed that six X-ray sources have ultrasoft X-ray spectra ($kT<3$ keV) similar to those of several black-hole candidates in the high state. These sources are LMC X-3, LMC X-1, 4U 0142+61, H1743−32, 4U 1755−33 and 4U 1957+11. There are no X-ray eclipses associated with the 4-day binary period proposed for LMC X-1. H1743−32 was a transient source, and five other transients (A0620−00, H1705−250, 4U 1543−47, A1524−62 and 4U 1630−47) also had similarly ultrasoft X-ray spectra. The sources H0845−33, A1742−294 and 4U 1907+09 have spectra similar to either the black-hole candidates in the low state or X-ray pulsars. (3 refs.)

69647 Do black holes exist?. R.A.Waldron (School of Math., Ulster Polytech., Newtonabbey, N Ireland).
Speculations Sci. & Technol. (Switzerland), vol.6, no.1, p.97-9 (April 1983).
As black holes are formed by gravitational collapse, a vast amount of heat is generated, and the star temperature may reach 10^{12}K. This will oppose collapse, until it has been shed, and in losing energy the star must also lose mass. Since the Schwarzschild radius r_s is proportional to mass, this also decreases; as the radius of the star decreases so does r_s, and the former never catches up with the latter. So how does a black hole ever form?. (6 refs.)

Black holes and the stability of gravitation .... See Entry 64766

Wormhole solutions in Einstein-Yang-Mills-Higgs system. II. Zero-order structure for $\mathcal{G}$=SU(2) .... See Entry 64783

Positive mass theorems for black holes .... See Entry 64801

Producion of tachyons from Schwarzschild black holes .... See Entry 64803

Is there a quantum equivalence principle? .... See Entry 64806

A mathematical solution of general relativistic binary systems .... See Entry 69648

LMC X-1: another massive binary? .... See Entry 69669

97.80 BINARY AND MULTIPLE STARS

(inc. extrasolar planetary systems)

69648 A mathematical solution of general relativistic binary systems. Kau-Un Lu (Dept. of Math., California State Univ., Long Beach, CA, USA).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.127-38 (Feb. 1983).
A mathematical solution for general relativistic binary systems is obtained. A conclusion concerning black holes in some binary systems is deduced from the mathematical solution. (11 refs.)

69649 Five years of photometry of λ Andromedae. R.W.Boyd (Boyd Obs., Miami, FL, USA), J.A.Eaton, D.S.Hall, G.W.Henry, R.M.Genet, L.P.Lovell, J.L.Hopkins, J.D.Sabia, K.Krisciunas, C.R.Chambliss, P.K.Detterline, H.J.Landis, H.Louth, T.R.Renner, D.R.Skillman, R.E.Montle.
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.197-206 (Feb. 1983).
The authors present photoelectric photometry of this bright long-period RS CVn binary and use it, along with earlier photometry, to derive the photometric period and discuss the changing light curve shape. The best ephemeris for times of minimum light is $2443829.2+53.95^d E$. Because times of minimum and maximum extending back to those of Calder in 1933-37 can be phased together properly, the principal dark region must have maintained its identity for almost 50 yr. Over the last five years the brightness range has been $3.70^m<V<4.05^m$. During 1980-81 shallow secondary minima developed at phases where maxima occurred in previous years. λ And remains the only well-established case of non synchronous rotation among the known RS CVn binaries. (28 refs.)

69650 Helium cyclotron emission from accreting magnetized neutron stars. K.M.V.Apparao, S.M.Chitre (Tata Inst. of Fundamental Res., Bombay, India).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.L1-3 (May 1983).
Finds that helium nuclei accreting onto magnetized neutron stars in strong X-ray sources can emit cyclotron radiation. In the case of the X-ray source 4U 0115+63, the He cyclotron line at 6 eV in the ultraviolet should be observable with the IUE satellite. (14 refs.)

69651 Statistics of binary stars: eclipse depths. G.Giuricin, F.Mardirossian, M.Mezzetti (Osservatorio Astron. di Trieste, Trieste, Italy).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.42-4 (May 1983).
Examines the available data on the depths of the primary eclipses of extensive samples of eclipsing binaries. The comparison with several corresponding theoretical distributions proposed in the literature (Halbwachs, 1981), corrected for observational limitation effects, suggests that decreasing distributions of the mass ratio are unrealistic (they would predict too great a number of low-amplitude binaries). (22 refs.)

69652 X-ray observations of bright galactic bulge sources in the vicinity of GX 5−1. M.van der Klis (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands), S.Rappaport.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.119-23 (May 1983).
Results are presented for 44d of pointed COS-B X-ray observations of the galactic centre region around GX 5−1. It is found that GX 5−1 exhibits relatively rapid ($\sim10^3$ s) intensity transitions as well as flaring events with a typical time scale of $\sim10^4$ s. Neither GX 5−1, GX 3+1 nor GX 9+1 shows evidence of periodic intensity modulations due to orbital motion on

time scales from minutes to fractions of a day. These results are discussed in the context of proposed models for bright galactic bulge sources. (22 refs.)

69653 An X-ray survey of nine Algol systems. N.E.White, F.E.Marshall (Lab. for High Energy Astrophys., NASA Goddard Space Flight Center, Greenbelt, MD, USA).
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L117-20 (15 May 1983).
The observed X-ray luminosities seen from an Einstein survey of nine Algol-like systems are similar to those found by Pallavicini et al. for single or widely separated, rapidly rotating late stars but fall an order of magnitude below those seen from RS CVn stars with similar orbital periods and spectral types. It is concluded that the X-ray emission is most probably associated with a hot corona surrounding the secondary. Possible explanations for the lower luminosity of the Algol systems relative to the RS CVn systems are considered. (19 refs.)

69654 The magnetic field on the RS Canum Venaticorum star lambda Andromedae. M.S.Giampapa, L.Golub (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA), S.P.Worden.
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L121-5 (15 May 1983).
A program to detect and measure magnetic flux on the surfaces of late-type stars is discussed. The authors adopt a technique to deconvolve magnetically insensitive lines from similar, magnetically sensitive lines to infer the degree of Zeeman splitting in the latter lines. These measurements yield values for the magnetic field strength and filling factor (flux). To illustrate their approach the authors present observations of the RS CVn star λ And. At the epoch of observation, 1981 April 26, they find a field strength of 1290±320 gauss covering 48%±7% of this star's surface. This measurement compares with an estimate of coronal magnetic flux in the cooler component of the stellar corona of 1110 gauss with a coronal volume filling factor of 75%, based on X-ray data for λ And. (22 refs.)

69655 X-ray evidence for white dwarf binaries in globular clusters. P.Hertz, J.E.Grindlay (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L83-7 (15 April 1983).
An apparently distinct class of low-luminosity ($L_x \sim 10^{32}$-10^{34} ergs s^{-1}) X-ray sources has been discovered in globular clusters from a survey with the IPC detector on the Einstein X-Ray Observatory. The sources appear to be pointlike, and several lie well outside of the cluster core, indicating that their masses are $\lesssim 1.0\ M_{\odot}$. These characteristics, together with previous studies of X-ray sources in globular clusters, make it likely that these sources are caused by accretion onto a white dwarf in a compact system. The luminosity function for these sources is consistent with that of galactic plane cataclysmic variables. The luminosity function for these sources is consistent with that of galactic plane cataclysmic variables. An extrapolation of the X-ray luminosity function to $L_x \lesssim N10^{31}$ erg s^{-1} indicates that a typical globular cluster contains $\sim 10^{1.3}$ white dwarf binaries. Assuming that these binaries form via the tidal capture (two-body) mechanism, the number of white dwarfs in a typical cluster must be $\sim 10^{4.1}$; this is consistent with globular cluster mass functions. (34 refs.)

69656 Definitive orbital elements of the visual double star ADS 5871-STF 1037. M.Scardia (Osservatorio Astron. di Brera, Merate, Italy).
Astron. Nachr. (Germany), vol.304, no.1, p.29-35 (1983).
Using a sample of 315 observations, the author computes the definitive orbital elements of the visual binary star ADS 5871-STF 1037. The provisional elements obtained by Kowalsky's method are corrected with the differential method of Hellerich. The author calculates the dynamical parallax of the system and its total mass. (21 refs.)

69657 New light curve analyses for the eclipsing binaries u Her and UV Leo. G.Giuricin, F.Mardirossian, M.Mezzetti (Osservatorio Astron. di Trieste, Trieste, Italy).
Astron. Nachr. (Germany), vol.304, no.1, p.37-40 (1983).
Using Woods's (1972) model the authors analyze two sets of photoelectric observations as yet unsolved, i.e. Rovithis's and Rovithis-Livaniou's (1980) B and V light curves of the semi-detached system u Her and Broglia's (1961) three-colour observations of the detached system UV Leo. The observations of u Her yield solutions in which the secondary's radius exceeds its Roche lobe. On the other hand, the new elements of UV Leo confirm the results of the most recent investigations, thus giving for the primary eclipse an unexpected occultation solution which hardly permits a simple picture of UV Leo. (35 refs.)

69658 Extreme surface activity on the cool component of the eclipsing binary FF Aquarii. J.D.Dorren, M.J.Siah, E.F.Guinan (Biruni Obs., Shiraz, Iran).
Inf. Bull. Variable Stars (Hungary), no.2305, p.1-4 (30 March 1983).
The eclipsing binary star FF Aquarii (=BD−3°5357) consists of a G8 III-IV component with strong Ca II H and K emission, and an OB-type subdwarf. The ultraviolet spectrum of the cool star alone shows strong chromospheric emission lines (e.g. Mg II h and k) and very strong transition region emission lines such as N V, C IV and C II. The authors report photoelectric photometry of FF Aquarii between July 1977 and August 1978 using the v,b and y filters of the Stromgren uvby system. The light curve is characterised by a wavelike variation with an amplitude of about 0.33 mag., in which the minimum and maximum of the wave occur at about phases 0.18 and 0.7 (for primary eclipse at phase 0.00). This light variation is similar to the quasi-sinusoidal photometric waves observed in RS Canum Venaticorum stars, and it is found that the light curve of FF Aquarii can, like the light curves of the RS CVn stars, to be fitted by a starspot model. It is concluded that about 42% of the surface of the G-type star is covered by starspots which are about 800K cooler than the stellar photosphere. (5 refs.)

69659 1980 light curve of II Pegasi. D.S.Hall, G.W.Henry (Dyer Obs., Vanderbilt Univ., Nashville, TN, USA).
Inf. Bull. Variable Stars (Hungary), no.2307, p.1-2 (8 April 1983).
The authors report V-band photometry of the RS Canum Venaticorum star II Pegasi on 25 nights in 1980. Magnitudes are listed for the period 1980 August 7 to November 12, and a light curve is presented. (1 ref.)

69660 1981 light curve of II Pegasi. R.D.Lines, H.Louth, H.J.Stelzer, D.S.Hall.
Inf. Bull. Variable Stars (Hungary), no.2308, p.1-2 (8 April 1983).
The authors report V-band photometry of the RS Canum Venaticorum star II Pegasi on 27 nights during 1981. V-band magnitudes for the period 1981 August 30 to November 13 are tabulated, and a light curve is presented. (2 refs.)

69661 1981-82 light curve of II Pegasi. G.W.Henry (Cloudcroft Obs., Cloudcroft, NM, USA).
Inf. Bull. Variable Stars (Hungary), no.2309, p.1-2 (8 April 1983).
The author reports differential V-band photometry of the RS Canum Venaticorum star II Pegasi on 19 nights between September 1981 and August 1982. The observed V-magnitudes are tabulated, and a light curve is presented. (1 ref.)

69662 Photoelectric observations of TY Del. D.R.Faulkner (Astron. Dept., Indiana Univ., Bloomington, IN, USA).
Inf. Bull. Variable Stars (Hungary), no.2310, p.1-2 (11 April 1983).
The author reports photoelectric UBV photometry of the Algol-type eclipsing binary star TY Delphini (BD+12°4539) on five nights during the autumn of 1982. Three times of minimum light are determined, and are used to calculate new light elements. (4 refs.)

69663 Photoelectric minima and period changes of CO Lacertae. J.M.Kreiner (Astron. Dept., Inst. of Phys., Silesian Univ., Katowice, Poland), M.Kurpinska-Winiarska, M.Winiarski.
Inf. Bull. Variable Stars (Hungary), no.2312, p.1-2 (15 April 1983).
The authors report photoelectric photometry of the eclipsing binary star CO Lacertae (BD+56°2857) for the period July 1981 to August 1982. Four times of light minimum (two primary eclipses and two secondary eclipses) are given. The (O−C) values are calculated for the observed minima, and the (O−C) curve is plotted for all the published photoelectric minima of CO Lacertae; it is concluded that the elements of Semeniuk (1967) are in good agreement with the observations. (7 refs.)

69664 Observations of the RS CVn star HD 26337 with the International Ultraviolet Explorer satellite. S.L.Baliunas, W.P.Blair, E.F.Guinan (Harvard-Smithsonian Centre for Astrophys., Cambridge, MA, USA).
Inf. Bull. Variable Stars (Hungary), no.2323, p.1-3 (26 April 1983).
HD 26337 (m=+7.05; G5 IV) is a single-line spectroscopic binary star (P=2.04414^d) with moderately strong Ca II H and K emission, and a small-amplitude variable star with a photometric period of 2.038^d. These properties are typical of RS Canum Venaticorum stars as defined by Hall (1976). The authors report observations of HD 26337 by the IUE satellite on four days between December 1982 and March 1983. The Fine Error Sensor on board the satellite was used as a photometer to measure the optical brightness of the star. It is found that the mean brightness of the star has decreased by 0.19 mag. from 1980-81 to 1982-83; in addition the amplitude of the light curve has decreased from about 0.16 mag. in 1980-81 to about 0.10 mag. in 1982-83. These changes imply that the area of the stellar surface that is covered by starspots has increased, and that there has been a net movement of the centres of the spots towards higher latitudes. Finally, ultraviolet observations of HD 26337 reveal moderately strong Mg II h and k (2800 Å) emission, indicative of a chromospherically active star. (9 refs.)

69665 The thirty-two year cycle in Algol. A.D.Mallama (Computer Sci. Corp., Silver Spring, MD, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.1-9 (1982).
Five new photoelectrically timed minima of Algol are reported: JD (hel.) 2443909.6538, 2444167.7182, 2444236.5321, 2444560.5340, and 2444623.6188. The ephemeris of Frieboes-Conde, Herczeg, and Hog (2434705.5493+2.86732442E^d) is still a good predictor if a correction term with 32-year periodicity is added. Apsidal motion is eliminated as the cause for the 32-year periodicity in the times of primary minimum because times of secondary minimum derived from observations in the literature do not fit that model, the deviation being at least 6 sigma. Likewise the 32-year effect appears to be unrelated to asymmetry in the light curve, at more than a 3 sigma confidence level. (24 refs.)

69666 A photoelectric light curve of AH Cephei. P.Hartigan, R.P.Binzel (Dept. of Phys. & Astron., Macalaster Coll., St. Paul, MN, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.21-4 (1982).
This B3-type eclipsing binary has a β Lyrae-type light curve of small amplitude. Between August 3 and November 24, 1978, 133 photoelectric observations of AH Cephei were obtained. A time of minimum derived from the mean light curve, JD$_{min}$ (hel.)=2442779.813±0.011 day, indicates the period may still be increasing. (3 refs.)

69667 AW Sagittarii—a neglected variable. W.B.Davie (Maria Mitchell Obs., Nantucket, MA, USA).
J. Am. Assoc. Variable Star Obs. (USA), vol.11, no.1, p.35-6 (1982).
AW Sagittarii, not observed since its discovery in 1904, has been identified and its variation has been confirmed. A finding chart is presented. Attempts to find a period are unsuccessful, largely due, it is thought, to the proximity of another star, also probably variable. (1 ref.)

69668 Relativistic conic sections. N.Spyrou (Astron. Dept., Univ. of Thessaloniki, Thessaloniki, Greece).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.363-74 (April 1983).
A classification of the possible types of the relative orbits of realistic binary stars in the post-Newtonian approximation of general relativity is presented. Definitions of the relativistic conic sections and their elements are proposed, generalizing the corresponding ones of classical celestial mechanics. The results are compared and contrasted with the classical ones and some new predictions of purely post-Newtonian origin and nature are presented. (30 refs.)

69669 LMC X-1: another massive binary?. J.B.Hutchings, D.Crampton, A.P.Cowley.
I.A.U. Circ. (USA), no.3791, 1 pp. (14 April 1983).
The authors report spectroscopic observations of the candidate star proposed by Pakull (IAUC 3472 (1980)) for LMC X-1. The star is found to be a spectroscopic binary of spectral type about 07 with a probable orbital period of 3.909 days. The orbital semiamplitude (about 65 km/s) and the presence of antiphased N III emission imply that the companion has a mass ≥3 M. (1 ref.)

69670 On the tidal spin up and orbital circularisation rate for the massive X-ray binary systems. G.J.Savonije (Astron. Inst., Univ. of Amsterdam, Amsterdam, Netherlands), J.C.B.Papaloizou.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.581-93 (May 1983).
Calculates the response of non-rotating main-sequence stars of 5, 10 and 20 solar masses to a periodic perturbing tidal potential. The fully non-adiabatic, but linearised, equations for the response are solved numerically. The results enable the spin up and orbital circularisation rates to be calculated for a wide range of orbital frequencies. The authors discuss the behaviour of these quantities for orbital parameters appropriate to the massive X-ray binaries. The spin up of the massive component appears to be rather inefficient in the calculations, unless the system could be locked into resonance. However, because the tidal torque is strongly concentrated in the outer layers these may be spun up (or for certain orbital frequencies spun down) much more efficiently. (21 refs.)

69671 The enigmatic composite system HD 45166—B8 V+qWR or SdO?. A.J.Willis (Dept. of Phys. & Astron., Univ. Coll. London, London, England), D.J.Stickland.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.619-35 (May 1983).
High- and low-resolution *IUE* ultraviolet spectroscopic observations of the binary system HD 45166, previously classified as qWR+B8 V, obtained at several epochs are presented. The UV spectra show a photospheric absorption spectrum from highly ionised species like Fe *v*, which with the observation of B8 V absorptions in the visible, confirms the binary nature of the system. UV

data obtained at different epochs show gross changes in the strengths of comparatively narrow emission lines in N IV, C III and He II. C IV λ 1550 shows a P Cygni profile indicating a significant stellar wind from the hot object in the system, with $v_\infty \sim 1200$ km s^{-1}. An analysis of the UV and visible continuum, which shows no apparent epoch variations, yields following parameters for the hot object: M_v, T_{eff}, log $L/L_\odot$, R, and M. The authors suggest that the hot stellar component may be an SdO rather than a qWR star. (26 refs.)

69672 Phase-dependent UV spectra of UX Ursae Majoris. A.R.King, J.Frank, R.F.Jameson, M.R.Sherrington (Dept. of Astron., Univ. of Leicester, Leicester, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.677-83 (May 1983).
Reports phase-dependent UV spectra of UX UMa. The behaviour of the continuum during eclipse is as expected for an optically thick accretion disc. The authors confirm that the C IV λ 1549 emission line is not eclipsed, and show that several other lines undergo partial or total eclipses. This behaviour is shown to be consistent with simple ideas about photoionized winds blown off the accretion disc: some parameters of the emission-line region are estimated. (11 refs.)

69673 Optical and IR light curves of VV Puppis. P.Szkody (Dept. of Astron., Univ. of Washington, Seattle, WA, USA), J.A.Bailey, J.H.Hough.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.749-57 (May 1983).
Presents optical (0.36-0.6 μm) light curves with time resolutions of seconds and infrared (IR) (1.25-2.2 μm) light curves with time resolutions of minutes for VV Puppis during a high state. The optical light curves show a single hump with largest amplitude in the V filter, while the IR light curves show a double hump sinusoidal variation. Flickering is evident in both the optical and IR light curves, with the largest amplitude in optical B light. Through subtraction of the low state fluxes from the high state values, the authors obtain a flux distribution of the accretion column which peaks at 0.55 μm and becomes ν^2 in the IR, consistent with current cyclotron models. Comparison of the observed IR variations throughout the orbit with the expected variations due to an M4 star heated by an accretion column at an inclination of 66° suggests that the IR light is a combination of the secondary star plus contributions from two emitting poles. (24 refs.)

69674 Confirmation of periodic radio outbursts from LSI+61° 303≡GT 0236+61. M.J.Coe, S.R.Bowring, A.J.Court, C.J.Hall, J.B.Stephen (Dept. of Phys., Univ. of Southampton, Southampton, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.791-4 (May 1983).
Radio data on GT 0236+61 at a frequency of 10.7 GHz have been obtained over the period 1981 May to 1982 April and the 26.52-day regular behaviour reported by Taylor and Gregory (1982) is confirmed. This source appears to be similar to several other long-period X-ray binaries such as Circinus X-1. (17 refs.)

69675 Ultraviolet spectroscopy of LSI+61 303. I.D.Howarth (Dept. of Phys. & Astron., Univ. Coll. London, London, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.801-10 (May 1983).
New *IUE* low-resolution spectroscopy of the X-ray/radio source LSI+61° 303 is presented and discussed, and previously reported data critically reassessed. There is no strong evidence for continuum variability; in particular, eight spectra covering the 1200-1950 Å region show a scatter of only ~3 per cent. There is some variability in the emission lines, possibly related to the star's shell activity. The C IV resonance doublet reveals a stellar wind with a terminal velocity of ~1400 km s^{-1}. The data are consistent with a 10 $R_\odot$, $T_{eff} \simeq 15500$K star at 2.3 kpc, reddened by $E(B-V)=0.75$. (21 refs.)

69676 Velocity standards that have variable velocities. I. HD 184467. R.D.McClure (Dominion Astrophys. Obs., Herzberg Inst. of Astrophys., Victoria, BC, Canada).
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.201-5 (March 1983).
Several standard-velocity stars have been found to have variable velocities, from observations over the last three years with the DAO radial-velocity spectrometer. HD 184467 is an IAU standard that has been found to be a double-line spectroscopic binary. Although the maximum velocity separation of the components is only 28 km s^{-1}, and the system is single lined for most of the velocity cycle, a good orbit solution could be obtained from these photoelectric observations. (7 refs.)

Cosmic rays from binary neutron stars .... See Entry 69453

On disk accretion .... See Entry 69483

Non-LTE analysis of subluminous O-stars. V. The binary system HD 128220 .... See Entry 69606

The influence of magnetic fields on nova outbursts .... See Entry 69611

A model for the standstill of the Z Camelopardalis variables .. See Entry 69612

Properties of Am, δ Del, and δ Sct stars in the VBLUW system .... See Entry 69613

An observational study of the influence of close companions on the pulsations of β Cephei stars .... See Entry 69614

Radial velocity variation of the Be star 6 Cep (HD 203467) .... See Entry 69619

Does S1910 vary? .... See Entry 69623

Transient X-ray rings around dwarf novae .... See Entry 69628

Another millisecond pulsar .... See Entry 69639

Potential black-hole candidates .... See Entry 69646

Emission-line profiles for selected planetary nebulae and symbiotic stars, V1016 Cygni, and HM Sagittae .... See Entry 69707

High spatial resolution VLA observations of the R Aquarii jet .... See Entry 69742

97.90 OTHER TOPICS IN STELLAR ASTRONOMY

69677 The AAO JHKL′ photometric standards. D.A.Allen, T.A.Cragg (Anglo-Australian Obs., Epping, NSW, Australia).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.777-83 (May 1983).
Presents the *JHKL′* standard stars in use for photometry at the Anglo-Australian Observatory. They are equatorial or southern hemisphere objects $1.5<K<6$ comparison with other lists of standards is presented, and in particular with the Johnson photometric system. Some recommendations on the use of *JHKL′* standard stars are given. (13 refs.)

98.00 STELLAR SYSTEMS; GALACTIC AND EXTRAGALACTIC OBJECTS AND SYSTEMS; THE UNIVERSE

98.10 STELLAR DYNAMICS

69678 Stellar orbits in a triaxial galaxy. I. Orbits in the plane of rotation. T.de Zeeuw (Sterrewacht, Huygens Lab., Leiden, Netherlands), D.Merritt.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.571-95 (15 April 1983).
An approximation technique for solving the equations of motion in nonintegrable potentials is applied to the case of stellar orbits in the plane of rotation of a nonaxisymmetric galaxy. The technique consists of (a) expanding the potential about the origin up to quartic terms and (b) replacing the corresponding Hamiltonian by a simpler averaged Hamiltonian, for which the equations of motion admit exact solutions. An explicit expression is obtained for the nonclassical second integral, and the major families of closed orbits are delineated. The results of the analytical technique are compared with orbits calculated numerically in the plane of rotation of Schwarzschild's triaxial galaxy model. It is suggested that most triaxial potentials are probably describable as 1:1:1 resonances, a result which has important implications for the existence of equilibrium triaxial galaxies. (76 refs.)

Dynamical constraints on star formation efficiency .... See Entry 69598

A numerical method for the study of the gravothermal instability in star clusters .... See Entry 69682

Dwarf elliptical galaxies .... See Entry 69720

98.20 STELLAR CLUSTERS AND ASSOCIATIONS

69679 Formation of OB clusters: W33 complex. A.D.Haschick (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA), P.T.P.Ho.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.638-46 (15 April 1983).
OB star formation in the W33 complex is studied using radio continuum interferometry and the spectral lines of NH_3. Although OB star formation is extended on the scale of 10 pc, the most recent episode of star formation producing the most massive stars in the region is confined to a 1 pc core within the dense molecular gas. The clumpy appearance of the H II region is consistent with the interpretation that a cluster of OB stars has formed recently in the core of the molecular cloud. (32 refs.)

69680 Color-magnitude photometry of 47 Tucanae to $M_V=+9$. W.E.Harris (Phys. Dept., McMaster Univ., Hamilton, Ontario, Canada), J.E.Hesser, B.Atwood.
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L111-15 (15 May 1983).
The authors present a color-magnitude diagram, obtained with the Cerro Tololo Inter-American Observatory vidicon system in direct mode, for the main sequence of 47 Tucanae (=NGC 104=C0021−723), to a limiting magnitude of V=22 ($M_V=+9$). The observed scatter along the main sequence is $\sigma(B-V)=0.04$ mag, consistent with the internal errors of measurement. Isochrone fits with Vanden Berg's (1983) recent stellar models are consistent with his conclusion that 47 Tuc has an age of $15-18\times10^9$ yr and a heavy-element abundance $Z\approx0.006$. (35 refs.)

69681 Abundance analyses of main-sequence stars in a possible nitrogen deficient cluster NGC 6231. D.J.Lennon, P.L.Dufton.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.443-56 (May 1983).
24 early-type main-sequence stars were observed at moderate dispersion in the cluster NGC 6231 and atmospheric parameters deduced from their Stromgren photometry and H_γ and H_ϵ absorption lines. Equivalent widths were measured for lines of He I, C II, N II, O II and Mg II, and abundances deduced from comparison with LTE and non-LTE model atmosphere calculations. Evidence is found for a systematic nitrogen under-abundance of 0.3 to 0.4 dex relative to hydrogen and this is interpreted as being due to a nitrogen deficiency in the progenitor interstellar material. Possible explanations for the anomalous composition are discussed. (35 refs.)

69682 A numerical method for the study of the gravothermal instability in star clusters. E.Bettwieser (Univ. Sternwarte, Gottingen, Germany).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.811-31 (May 1983).
Describes a numerical method for studying the evolution of spherical one-component star clusters. This method employs numerical integration of the moment equations derived from the Boltzman equation. In order to close this system of equations it is assumed that the energy flux tensor can be derived from an appropriate heat conduction law. The author allows for a large anisotropy of the velocity distribution and includes relaxation effects which are evaluated using the Fokker-Planck theory. Detailed numerical results from a study of the evolution of Plummer's (1915) model are reported. The evolution has been followed to that point where the central density $\rho(0)$ increased by a factor of 10^{14}. Only in the late stages of evolution the core collapse rate $(\dot{\rho}/\rho)$ is a fixed fraction of the relaxation rate. The velocity distribution represented by six moments seems to approach a self-similar form. The comparison of different outer boundary conditions and with former work indicates that this form is independent of the structure of the outer halo. These results provide new evidence that core collapse and the onset of the homological phase in the late stages of it is due to the gravothermal catastrophe picture of Lynden-Bell and Wood (1968). (47 refs.)

Polytropic spheres with isothermal cores .... See Entry 69484

Dynamical constraints on star formation efficiency .... See Entry 69598

Discovery of a nitrogen-rich UV-bright star in the globular cluster M5 .... See Entry 69607

X-ray evidence for white dwarf binaries in globular clusters ... See Entry 69655

New polarisation measurements of HD 183143, HD 204827, and Cyg OB 2 Sch. No.12 .... See Entry 69691

A survey of formaldehyde in the Cepheus OB3 molecular cloud .... See Entry 69704

98.40 INTERSTELLAR MATTER; AND NEBULAE

69683 High-velocity outflow sources in molecular clouds: the case for low-mass stars. S.Beckwith (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA), A.Natta, E.E.Salpeter.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.596-602 (15 April 1983).
Using calculations of the evolution of single explosions and time-extended outflows in molecular clouds, the energy and time required to produce the

high-velocity molecular outflow observed in Orion are derived for spherical expansion models. The energy efficiency of extended outflows is somewhat greater than that of single explosions in producing the observed velocity, radius, and mass of the outflow, but the efficiencies differ by less than a factor of 2. From the number of sources of high-velocity outflow, the present age of each outflow, and estimates of incompleteness of the detections, the authors estimate a rate of outflow occurrence more than 3 times greater than the formation of stars more massive than 4 $M_\odot$. It is argued that low-mass stars are likely to produce the bulk of the outflowing regions in molecular clouds. (36 refs.)

69684 UV radiation field inside dense clouds: its possible existence and chemical implications. S.S.Prasad, S.P.Tarafdar (Jet Propulsion Lab., California Inst. of Technol., Pasadena, CA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.603-9 (15 April 1983).
It appears possible that cosmic ray excitation of the Lyman and Werner systems of the hydrogen molecule could maintain a chemically significant level of UV photon flux in the interior of dense clouds where interstellar UV radiation may not reach. This conclusion is based upon a simplified treatment of the radiative transfer problem, which actually tends to underestimate the radiation field. In particular, the predicted radiation field seems capable of recovering carbon from the CO reservoir by photodissociation at an order of magnitude faster rate than that possible via dissociative charge transfer from He^+ followed by neutralization of the C^+ ion. This is noteworthy in the context of high $N(C)/N(CO)$ ratios reported for several dense clouds. Furthermore, this radiation field may also provide a potentially viable means of releasing molecules from grain surfaces inside dark clouds. (20 refs.)

69685 X-ray ionization and the Orion molecular cloud. J.H.Krolik (Center for Space Res., MIT, Cambridge, MA, USA), T.R.Kallman.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.610-24 (15 April 1983).
The observed X-ray sources near the core of the Orion molecular cloud are sufficient to supply all the ionization that is needed to drive the molecular chemistry throughout that portion of the cloud in which the greatest density and diversity of molecular species is found. In small regions within that core, the ionization rate is so high that the molecular balance is significantly different from that in the bulk of the cloud core's volume. Equilibrium models are calculated to determine the dependence of molecular abundances on ionization rate, and an exemplary model is constructed to show how this data may be assembled to predict total column densities. (55 refs.)

69686 VLA observations of the $^2\pi_{3/2}J=3/2$ OH masers associated with Orion A. S.S.Hansen (Nat. Radio Astron. Obs., Charlottesville, VA, USA), K.J.Johnston.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.625-9 (15 April 1983).
The maser emission in the $^2\pi_{3/2}J=3/2$ $F=1\rightarrow2$ and $F=1\rightarrow1$ transitions of OH associated with Orion A was found to lie in an area 8″×3″ along a position angle of 70°. It is located in two clusters centered at velocities of 7 and 19 km s^{-1}, distributed symmetrically on either side of IRc2. The emission is consistent with the outflow of material from a central massive star associated with IRc2. The magnetic field in the OH maser region obtained from the positional coincidences of possible Zeeman pairs is ~3 milligauss. (12 refs.)

69687 The ionization structure of planetary nebulae. III. NGC 7009. T.Barker (Dept. of Phys. & Astron., Wheaton Coll., Norton, MA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.630-7 (15 April 1983).
For pt.II see ibid., vol.253, no.1, pt.1, p.167-73 (1982). Spectrophotometric observations of emission line intensities have been made in eight positions in the planetary nebula NGC 7009. For the six brightest positions, the coverage is from 1400 Å to 10,000 Å. Standard equations used to correct for the existence of elements in other than the optically-observable ionization stages give results over a wide range of ionization that are consistent and agree with abundances calculated using ultraviolet lines. (17 refs.)

69688 The Gum Nebula: new photometric and spectrophotometric results. A.Chanot, J.P.Sivan (Lab. d'Astron. Spatiale, CNRS, Marseille, France).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.19-25 (May 1983).
On the basis of 60°-field, Hα photographs, the Gum Nebula appears to be composed of two regions: a 36°-diameter circular main body which has a typical ring-like appearance, and faint, diffuse and filamentary extensions which merge with surrounding Hα background. The overall dimensions do not exceed about 50° in diameter. Quantitative analysis of the plates has provided us with the total number of Hα photons emitted by the nebula. The flux of Lyman continuum photons from γ^2 Vel and ζ Pup appears to be capable of maintaining the observed ionization. In over 300 directions toward the Nebula, the authors have measured the [N II] 6584/Hα, [S II] 6717, 6731/Hα, [S II] 6717/[S II] 6731 and [O III] 5007/Hβ line intensity ratios. (57 refs.)

69689 The Cygnus X region. XIII. The dark cloud between IC 1318b and c. H.J.Wendker, K.J.Schramm, C.Dieckvoss (Hamburger Sternwarte, Hamburg, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.69-76 (May 1983).
For pt.XII see ibid., vol.89, no.1/2, p.239-40 (1980). Presents new observations of the dark cloud between the emission nebulae IC 1318b and c in Cygnus. The H_2CO- and H I-absorption lines and the H 110α-emission line, together with data from the literature are used to elaborate on the nature of the dark cloud. The authors conclude that this dark cloud is the left-over of a much larger one, where star formation has ceased and where the dark cloud is being dissolved by an OB association, which is outlined by H II regions in the same line of sight. The authors also suggest in passing that the dark cloud may be the γ-ray source CG 0 78+01. (27 refs.)

69690 A search for optical polarisation of the Milky Way at $l=150°$ and $l=223°$. C.Leinert, I.Richter (Max-Planck-Inst. fur Astron., Heidelberg, Germany).
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.146-9 (May 1983).
The results of a search for polarisation of the Milky Way at $l=150°$ and $l=223°$ are reported. The observations, carried out with the Helios spacecraft, refer to an elongated field of view, 19°×2°, inclined at 43° with respect to the galactic equator. Taken as they are, the data indicate a small polarisation perpendicular to the galactic plane, the polarised intensity being $\approx 1S_{10}(V)$ at $l=150°$ and $\approx 2S_{10}(V)$ at $l=223°$. This is qualitatively similar but quantitatively lower than the results of earlier investigations. The results show that it is possible to get reliable observations of Milky Way polarisation by a spaceborne photometer in spite of the omnipresence of zodiacal light. (12 refs.)

69691 New polarisation measurements of HD 183143, HD 204827, and Cyg OB 2 Sch. No.12. A.Schulz (Max-Planck-Inst. fur Radioastron., Bonn, Germany), R.Lenzen.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.158-61 (May 1983).
Carries out measurements of linear polarisation of HD 183143, HD 204827, and Cyg OB2 Schulte No.12 in the spectral range of 0.3-1.1 μm obtaining accurate data which might be used in the future for instrumental calibrations. Combining them with published near infrared polarisation data for these 3 stars the authors find an excellent agreement with the wavelength dependence of interstellar polarisation given by Wilking et al. (1980) using a slightly changed width of the fit curve. (15 refs.)

69692 G29.7−0.3: another supernova remnant with an identity crisis. R.H.Becker (Phys. Dept., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA), D.J.Helfand, A.E.Szymkowiak.
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L93-7 (15 May 1983).
New radio and X-ray observations of the galactic supernova remnant G29.7−0.3 show that it is composed of two spectrally distinct components: a steep-spectrum, incomplete shell 3′ in extent enclosing a flat-spectrum, X-ray emitting region 30″ across. Thus, G29.7−0.3 joins the ranks of supernova remnants which exhibit a combination of Crab-like and shell remnant attributes. The Crab-like core has the highest ratio of X-ray to radio luminosity of all the Crab-like remnants observed to date, suggesting that it is an extremely young object. (16 refs.)

69693 The Galaxy's 157 micron [C II] emission: observations by means of a spectroscopic lunar occultation technique. G.J.Stacey, S.D.Smyers, N.T.Kurtz, M.Harwit (Center for Radiophys. & Space Res., Cornell Univ., Ithaca, NY, USA).
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L99-102 (15 May 1983).
The authors have obtained a first, direct estimate of galactic [C II] 157 μm, fine-structure emission. At a galactic longitude of 8°, the peak power observed in a 7′×7′ field is $\sim 5\times10^{-9}$ W cm^{-2} sr^{-1}. The method used to detect this radiation involved chopping against the cold side of the Moon. In the next few years, higher resolution far-infrared spectroscopy should enhance the usefulness of occultation techniques for detecting faint, diffuse line emission. (19 refs.)

69694 PL 1547.3−5612: a pure nitrogen ring nebula. M.T.Ruiz (Dept. de Astron., Univ. de Chile, Santiago, Chile).
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L103-9 (15 May 1983).
A ring nebula of pure nitrogen has been found with a radius of 0.6 pc and at about 4 kpc from the Sun. The emission from the region inside the ring is of more normal composition, containing lines of H, O, S, and N. No obvious central star is seen. (3 refs.)

69695 High-density gas associated with 'molecular jets': NGC 1333 and NGC 2071. P.R.Schwartz, J.A.Waak, H.A.Smith (Naval Res. Lab., Washington, DC, USA).
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L109-14 (15 April 1983).
The authors have observed the high-density gas associated with broad-winged bipolar CO emission in NGC 1333 and NGC 2071 by mapping these objects in $C^{18}O$, $NH_3(1,1)$ and CS (J=3-2). The general structure of high-density interstellar gas near these objects is elongated orthogonal to the separation of the 'red' and 'blue' high-velocity CO components. This suggests that a stellar wind is interacting with a primary planar parent cloud, snowplowing material into a lumpy, high-density torus in the plane of the cloud and excavating a cavity containing high-velocity, low-density gas perpendicular to the plane of the cloud. (16 refs.)

69696 Positions of the SiO masers in Orion-KI: anisotropy on a scale of 70 AU. M.C.H.Wright, R.L.Plambeck (Radio Astron. Lab., Univ. of California, Berkeley, CA, USA).
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L115-20 (15 April 1983).
Using the Hat Creek interferometer the authors have measured the positions of the −5 km s^{-1} and +16 km s^{-1} features in the spectrum of the $v=1$, $J=2\text{-}1$ SiO maser ($\nu=86.243$ GHz) in Orion-KL. The mean position of the two features, measured relative to a set of reference quasars, is $\alpha(1950)=5^h32^m47.023^s\pm0.005^s$ $\delta(1950)=-5°24'23.65''\pm0.15''$. This position lies within the error bars of the best infrared measurements of the position of the infrared source IRc2. There is a small, but significant, difference in the positions of the two masers. The −5 km s^{-1} feature is offset by $\Delta\alpha\cos\delta=0.10''\pm0.01''$, $\Delta\delta=-0.10''\pm0.02''$ from the +16 km s^{-1} feature. This offset corresponds to a separation of 70 AU at the distance of Orion. The anisotropy in the maser source, at distances of only $\sim10^{15}$ cm from IRc2, strongly suggests that IRc2 is the source of the high-velocity molecular outflow in Orion. (9 refs.)

69697 Radiative association and the synthesis of long carbon chain molecules in interstellar clouds. D.R.Bates (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L121-4 (15 April 1983).
An attractively simple scheme by which molecules having long carbon chains are formed in interstellar clouds through the radiative association family $C_n+C^+\rightarrow C_{n+1}{}^+ + h\nu$ is examined. It is rejected as probably being much too inefficient. Other schemes involve the synthesis of a big molecule in a single step, as for example $NH_3+CH_3{}^+\rightarrow NH_3.CH_3{}^+ + h\nu$ on which related flow-tube experiments have been performed. Exothermic dissociative channels exist. It has been inferred from the experimental data that the branching ratios determined in the laboratory are applicable to interstellar cloud conditions. This inference is unjustified. If a competing exothermic channel exists, it will in general severely suppress the radiative association rate coefficient. (23 refs.)

69698 Three-micron spectrometry in Sharpless 106. P.M.Williams, W.J.Zealey (Royal Obs., Edinburgh, Hilo, HI, USA).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.433-41 (May 1983).
The strength of the 3.28 μm emission feature has been measured at 12 positions in the biconical nebula Sharpless 106. The correlation of line-strength with thermal continuum confirms the association of the 3.28 μm line carrier with the cool dust. This correlation holds across the HII region, including the ionisation fronts, over a four-fold range of linestrength. In contrast to the results reported in Orion, there is no evidence for preferential line formation where the H II region interacts with the molecular cloud. The correlation of 3.28 μm linestrength with Brackett linestrength at three beam positions away from the excitation source strengthens the view that the dust and gas are well mixed in Sharpless 106. (14 refs.)

69699 The collapse of a fast rotating interstellar gas cloud. S.Narita, D.McNally, G.L.Pearce, S.A.Sorensen (Dept. of Phys. & Astron., Univ. Coll., London, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.491-515 (May 1983).
Numerical simulations have been performed of the hydrodynamical collapse of an axisymmetric, isothermal cloud which is initially a uniform sphere in fast rigid-body rotation. The cloud undergoes repeated collapses and bounces. Each time it collapses, it becomes a highly flattened disc which is fairly homogeneous in the equatorial plane; an off-axis density wave appears, moves away from the centre and disappears. It is found that centrifugal bounces do not lead to the formation of a permanent ring-like structure contrary to the results of some other investigators. (17 refs.)

69700 Radio maps revealing shell structures in five supernova remnants. J.L.Caswell, R.F.Haynes, D.K.Milne, K.J.Wellington (Div. of Radiophys., CSIRO, Epping, NSW, Australia).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.595-601 (May 1983).
Five southern supernova remnants (SNRs) of small angular diameter (5-10 arcmin) have been mapped with the Fleurs synthesis telescope; at the resolution used (better than 1 arcmin) a shell structure can be seen in each remnant. One of the SNRs G342.p−0.2, is a faint source which the authors confirm as an SNR for the first time. This source and three others, G340.4+0.4, G340.6+0.3 and G341.9−0.3, lie close together on the sky; they have similar distance estimates of ~16 kpc and they all may be located in one of the spiral arms on the far side of the Galaxy. The fifth SNR, G352.7−0.1, although displaced from the others by more than 10°, is at a similar distance and is possibly in the same spiral arm. (19 refs.)

69701 Observations of the $3_{1,3}$-$2_{0,2}$ transition of SO_2. G.J.White (Dept. of Phys., Queen Mary Coll., London, England), J.P.Phillips.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.661-6 (May 1983).
The authors have measured the $3_{1,3}$-$2_{0,2}$ transition of SO_2 in W49, W51, Ori A and Sgr B2, and found SO_2 emission upper limits in a further seven sources. The total number of SO_2 molecules in individual clouds is found to range from $\sim 2\times 10^{51}$ to $\sim 10^{53}$, implying a relative abundance $X(SO_2)\sim 10^{-6}$ in Ori A, and lower limits varying from $X(SO_2)\sim 10^{-9}$ to $\sim 10^{-8}$ in the remaining sources. These results are briefly discussed within the context of current models of interstellar cloud chemistry. (20 refs.)

69702 Radio observations of the supernova remnant G 109.1−1.0. A.Downes (Cavendish Lab., Mullard Radio Astron. Obs., Cambridge, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.695-9 (May 1983).
The supernova remnant G 109.1−1.0 which contains a periodic X-ray point source, has been observed with the Effelsberg 100-m telescope at 2.7 GHz. The remnant has shell structure at both radio and X-ray wavelengths and the radio and X-ray maps show similar large-scale emission. No linearly polarized radio emission was detected. G 109.1−1.0 is one of three shell remnants in which the probable stellar remnant has now been found. (26 refs.)

69703 Detection of H_2 emission in Herbig-Haro object No.101. A.Brown (Dept. of Phys., Queen Mary Coll., London, England), T.J.Millar, P.M.Williams, W.J.Zealey.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.785-9 (May 1983).
Reports the detection of H_2 emission in the spectrum of HH 101. The line strength of the $\nu=1$-0 $S(1)$ line at 2.12 μm is $(4.2\pm 0.6)\times 10^{-17}$ W m^{-2} and indicates that a shock with a velocity of about 14 km s^{-1} is moving into a cloud of density about 10^3 cm^{-3} if Schwartz's model for Herbig-Haro objects is valid. (15 refs.)

69704 A survey of formaldehyde in the Cepheus OB3 molecular cloud. R.W.Few (Computer Aided Design Centre, Cambridge, England), R.J.Cohen.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.853-9 (May 1983).
The 1_{11}-1_{10} absorption line of formaldehyde at 6-cm wavelength has been surveyed over the region of the Cepheus OB3 molecular cloud, using the Jodrell Bank Mk II radio telescope (beamwidth 9×10 arcmin^2). The measurements have a velocity resolution of 0.27 km s^{-1} and an rms noise level of ~0.01K. The formaldehyde has a very clumpy distribution which is broadly similar to the CO distribution found by Sargent (1977, 1979). A total molecular mass of 1.9×10^4 $M_\odot$ is implied by the formaldehyde measurements. Cepheus A is not the dominant concentration in the formaldehyde map. The most massive formaldehyde concentration is Cepheus C, which has a mass of 3600 $M_\odot$. It appears to be stabilized by rotation. (19 refs.)

69705 Structure of the local interstellar medium and the line of sight to α Oph. F.Paresce (Arcetri Astrophys. Obs., Florence, Italy).
Nature (GB), vol.302, no.5911, p.806-8 (28 April 1983).
Points out that a surprising number of independent lines of observational evidence unambiguously imply the existence of a large, moderately dense ($n_H\geq 1$ cm^{-3}), cool ($T\simeq 70$K) cloud of interstellar gas lying between the Sun and α Oph, an A5V star located 16.7±0.8 pc away in the direction $l=32°$, $b=23°$. (32 refs.)

69706 The optical emission from the supernova remnant HB 3. R.A.Fesen, T.R.Gull (Lab. for Astron. & Solar Phys., Goddard Space Flight Center, Greenbelt, MD, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.196-200 (March 1983).
Reports finding a faint, complete optical shell structure visible on Hα+[N II] and [S II] interference-filter photographs that is coincident with the radio emission of the supernova remnant HB 3. This shell, if associated with the remnant, represents a more extensive optical structure for HB 3 than previously recognized. (21 refs.)

69707 Emission-line profiles for selected planetary nebulae and symbiotic stars, V1016 Cygni, and HM Sagittae. D.E.Welty (Yerkes Obs., Univ. of Chicago, Williams Bay, WI, USA).
Publ. Astron. Soc. Pac. (USA), vol.95, no.565, p.217-28 (March 1983).
Emission-line profiles are given for twelve planetary nebulae in Hα and for seven in [O III] λ5007, for four symbiotic stars in Hα, and for the emission objects V1016 Cyg and HM Sge in both Hα and λ5007. Expansion velocities generally between 10 and 30 km s^{-1} are estimated for the planetary nebulae; the profiles are similar in Hα and λ5007 in most cases for which both are available. The profiles for V1016 Cyg, HM Sge, and the symbiotic stars are much wider and in most cases exhibit variability and multiple components. In particular, the variations in the line profiles of V1016 Cyg and HM Sge are displaced and described. (49 refs.)

The nuclear hyperfine structure of deuterated ammonia ....See Entry 65964

Models of the formation of the solar nebula ....See Entry 69515

Some cosmochemical consequences of a turbulent protoplanetary cloud ....See Entry 69516

Extraterrestrial Lyman α and helium 584 Å resonance radiation from the near solar system ....See Entry 69547

On the origin and structure of stellar magnetic fields ....See Entry 69593

Hydrogen sulfide in a circumstellar envelope ....See Entry 69594

Dynamical constraints on star formation efficiency ....See Entry 69598

The upper mass limit for white dwarf progenitors and the initial-final mass relation for low and intermediate mass stars ....See Entry 69605

Discovery of a nitrogen-rich UV-bright star in the globular cluster M5 ....See Entry 69607

Transient X-ray rings around dwarf novae ....See Entry 69628

Theory of NP 0532 pulsar radiation and the nature of the activity of the Crab Nebula ....See Entry 69638

Formation of OB clusters: W33 complex ....See Entry 69679

The radial distribution of H II regions in spiral galaxies ....See Entry 69713

Periodic orbits and warps ....See Entry 69716

Observations of the interacting galaxy pair NGC 4490/85 .....See Entry 69717

VLA observations of massive star formation in spiral nuclei ...See Entry 69721

The gas density and distribution within 2 parsecs of the galactic center ....See Entry 69722

Stochastic effects in the chemical evolution of galaxies ....See Entry 69727

Extended H I emission associated with the low-surface-brightness companions of the S0 galaxy NGC 4026 ....See Entry 69738

98.50 THE GALAXY, EXTRAGALACTIC OBJECTS AND SYSTEMS

69708 The ultraviolet spectrum of the Seyfert galaxies NGC 3516 and NGC 5548. M.H.Ulrich, C.Boisson (European Southern Obs., Garching, Germany).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.515-27 (15 April 1983).
The two Seyfert 1 galaxies NGC 3516 and NGC 5548 have been observed with the International Ultraviolet Explorer. In both galaxies the ultraviolet continuum becomes harder when it brightens. Analysis of the emission lines permits the structure of the broad line region to be partially unravelled. In contrast to most quasar spectra, the C IV λ1550, Mg II λ2800 and C III λ1909 line have different profiles, with C IV being broader than Mg II which is broader than C III. The differences between the profiles provide evidence for the existence of at least three types of clouds with different physical conditions and different velocities; the physical conditions correlate with the velocities of the clouds. (45 refs.)

69709 H I observations of the high-velocity system in NGC 1275. J.H.van Gorkom, R.D.Ekers (Kapteyn Astron. Inst., Groningen, Netherlands).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.528-34 (15 April 1983).
An attempt to detect H I emission from the high-velocity system in the Seyfert galaxy NGC 1275 (Perseus A) is presented. The data were obtained with the Westerbork Synthesis Radio Telescope using a special calibration procedure to achieve high spectral dynamic range. The new upper limit of 2.4×10^9 $M_\odot$ for the total H I mass in this system makes it unlikely that it is a very late-type galaxy, but the limit is still not low enough to exclude galaxies of type Sc or earlier. A tentative detection of a new weak broad absorption feature is reported, and the implications of an observed 30% increase in the intensity of the strong absorption feature are discussed. (17 refs.)

69710 Further evidence for M87's massive, dark halo. D.Fabricant, P.Gorenstein (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.535-46 (15 April 1983).
X-ray data obtained with the Einstein Observatory imaging proportional counter (IPC), supported by data from other detectors aboard the Einstein Observatory and previous instruments, are used to accurately measure the distribution of mass surrounding M87 at large radial distances that are inaccessible to optical study. An essentially complete range of possible temperature profiles for the X-ray emitting gas is considered. (31 refs.)

69711 Thermal conduction and heating by nonthermal electrons in the X-ray halo of M87. W.H.Tucker, R.Rosner (Harvard-Smithsonian Center for Astrophys., Cambridge, MA, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.547-50 (15 April 1983).
A hydrostatic model for the X-ray halo around the giant elliptical galaxy M87 is presented. By taking into account the processes of thermal conduction, and nonthermal heating by relativistic electrons in the radio lobes, a self-consistent hydrostatic model can be constructed. There is no need to invoke radiative accretion or the suppression of thermal conductivity. (17 refs.)

69712 Star bursts and the extraordinary galaxy NGC 3690. R.D.Gehrz (Wyoming Infrared Obs., Univ. of Wyoming, Laramie, WY, USA), R.A.Sramek, D.W.Weedman.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.551-62 (15 April 1983).
Optical, infrared, and radio observations are used to interpret the interacting galaxy system NGC 3690 (Markarian 171) in the context of exceptional episodes of star formation of a luminosity comparable to the brightest analogous episodes in galatic nuclei. Models for star formation with a range of parameters are presented to demonstrate consistent interpretations of the emission-line, far-infrared, and radio continuum fluxes as arising from the effects of large numbers of massive stars. (32 refs.)

69713 The radial distribution of H II regions in spiral galaxies. P.W.Hodge (Univ. of Washington, Seattle, WA, USA), R.C.Kennicutt,Jr..
Astrophys. J. (USA), vol.267, no.2, pt.1, p.563-70 (15 April 1983).
Examines the radial distribution of H II regions in the rectified planes of 37 galaxies. They group themselves into three broad classes: those with continually decreasing density outward, those with oscillating density, and those with doughnut-shaped density distributions. A correlation is found with absolute magnitude, which increases along the sequence. Most galaxies' outer H II region distributions show an exponential decrease in density, with a slope that is strongly correlated with Hubble type and absolute magnitude. A correlation is also found between Hubble type and the size of H II region density fluctuations, in the sense that later Hubble types show smaller differences in H II region density. (34 refs.)

69714 Are there correlations between radio and optical axes of radio galaxies?. M.J.Valtonen (Turku Univ. Obs., Turku, Finland).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.207-15 (Feb. 1983).
The relative orientations of radio and optical axes of radio galaxies have been examined on the basis of combined material from several smaller samples. Rotation axes of some radio galaxies have been redetermined assuming that the published measurements refer to rotational motions only. It is found that the rotation axis is quite different from those previous determinations, where rotation-expansion models were used. In particular, the correlation between radio source axes and rotation axes disappears when the allowance for expansion is dropped. No statistically significant correlation between optical major axes of the galaxy image and radio source axes is found when all existing measurements, now exceeding 140, are combined. (27 refs.)

69715 Pairs of spiral galaxies with magnitude differences greater than one. H.Arp (Mount Wilson & Las Campanas Obs., Carnegie Instn. of Washington, Pasadena, CA, USA), E.Giraud, J.W.Sulentic, J.P.Vigier.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.26-8 (May 1983).
For isolated physical pairs of spiral galaxies in Karachentsev's (1972) catalog, the authors show that where the difference in brightness is greater than one magnitude, the fainter galaxy has a significantly higher redshift on the average. This result confirms, in an independent sample of morphologically similar galaxies, the result which has come from every other test of companion galaxies—that they are systematically higher in redshift than the brighter galaxy. (20 refs.)

69716 Periodic orbits and warps. W.A.Mulder (Sterrewacht, Huygens Lab., Leiden, Netherlands).

Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.91-6 (May 1983).

Orbit calculations are carried out in a rotating triaxial system having a density distribution in accordance with recent observations of spiral galaxies. A search is made for simple closed orbits that are tilted with respect to the equatorial plane of the galaxy. A new family of stable prograde tilted orbits is found which can explain warps as almost stationary phenomena. The results give strong support to Binney's (1978, 1981) proposal that warps can be excited by orbital instability. A scenario is described in which gas in the equatorial plane slowly spirals inwards, is fed onto the prograde tilted orbits by orbital instability and eventually ends up as high-velocity clouds due to the intersection of the more inclined orbits. (23 refs.)

69717 Observations of the interacting galaxy pair NGC 4490/85. U.Klein (Max-Planck-Inst. fur Radioastron., Bonn, Germany).

Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.150-2 (May 1983).

The interacting galaxy pair NGC 4490/85 (Arp, 269) has been observed with the Effelsberg 100-m telescope at 24.5 GHz. The radio emission at that frequency is strongly correlated with the regions of ionised gas that can be seen in Hα. The fraction of thermal emission at 1.2 cm wavelength is $38\pm12\%$. This suggests that also an appreciable amount of non-thermal emission originates in the H II complexes of this double system. Supernovae resulting from tidally triggered star formation bursts must be the sources of relativistic electrons. Some 2×10^5 O 5 stars are required to account for the observed production rate of Lyman continuum photons. The derived present star formation rate is consistent with models of galaxy evolution. (10 refs.)

69718 Physical properties of the intergalactic medium and the Lyman-alpha absorbing clouds. J.P.Ostriker, S.Ikeuchi (Princeton Univ., Princeton, NJ, USA).

Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L63-8 (15 May 1983).

Following the interpretation of Sargent et al. (1980) that the Lyα absorbing systems seen in quasars are due to intergalactic clouds confined by the pressure of a general intergalactic medium, the authors determine the physical properties of that medium and of the clouds on the basis of a variety of theoretical and observational constraints, with best estimates of the present intergalactic pressure and temperature being $P/k=10^{-2\pm0.2}$ cm^{-3}K and $T=10^{4.5\pm0.5}$K. Both the clouds and the background intergalactic medium have a density too low to be cosmologically interesting. At the same time, it is shown that a model of the intergalactic medium based on UV heating fails and that some explosive events must have occurred which shock-heated the medium during the epoch $z=3\sim7$. The authors propose three specific, if difficult, observations to check the interpretation developed: a search for the He$^+$ Gunn-Peterson line at 304 Å, a better determination of the Doppler width of the normal Lyα lines, and a search for low equivalent width Lyα lines. (16 refs.)

69719 Detection of $10^{10}M_\odot$ of hot gas in the normal elliptical galaxy NGC 5846 with the Einstein satellite. P.Biermann (Max-Planck-Inst. fur Radioastron., Bonn, Germany), P.P.Kronberg.

Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L69-73 (15 May 1983).

Reports the detection of $\gtrsim1.2\times10^{10}M_\odot$ of hot gas in the elliptical galaxy NGC 5846. The gas density, temperature, cooling time, and luminosity in the 0.5-4.5 keV band are reported. A number of conclusions can be drawn: the X-ray luminosity conforms to the predictions of Silk and Tarter; the pressure of the hot gas provides a means to confine jets; the origin of the gas can be understood in the framework of the galactic wind theory, and thus both supernova heating and stripping are important processes for removing gas from a galaxy. At the center of NGC 5846, there is a cooling flow which probably results in both star formation of low-mass stars and fueling of the weakly active nucleus. (36 refs.)

69720 Dwarf elliptical galaxies. H.Gerola (IBM Thomas J. Watson Res. Center, Yorktown Heights, NY, USA), P.Carnevali, E.E.Salpeter.

Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L75-8 (15 May 1983).

The authors propose that dwarf elliptical galaxies are the bound remnants of more massive stellar systems, such as a parent galaxy which has lost more than half its mass in gas ejection during a burst of star formation, or an unbound tidal debris produced during the interaction of two giant galaxies. N-body calculations were performed to study the evolution of stellar systems with positive energy. The results indicate the existence of a power-law relation between the mass and the density σ of the fragments over a large range of values of σ, consistent with recent observational evidence. The calculations predict a mass-metallicity relation for the fragments. The amount of unbound material in the Virgo Cluster that is genetically connected with its dwarf elliptical galaxies is not detectable at present. (15 refs.)

69721 VLA observations of massive star formation in spiral nuclei. J.L.Turner, P.T.P.Ho (Dept. of Astron., Univ. of California, Berkeley, CA, USA).

Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L79-83 (15 May 1983).

The authors utilize both the spectral and spatial information in high-resolution radio continuum maps to decouple thermal emission due to H II regions from the extended, strong synchrotron emission found in galactic cores. A first-order analysis, assuming constant spectral indices across the maps, yields thermal fluxes to within a factor of 2. The presence of large numbers of H II regions and young stars in the nuclear regions of three nearby spiral galaxies is confirmed. (18 refs.)

69722 The gas density and distribution within 2 parsecs of the galactic center. R.L.Brown (Nat. Radio Astron. Obs., Charlottesville, VA, USA), K.J.Johnston.

Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L85-8 (15 May 1983).

The galactic center has been mapped with the VLA using a configuration optimized to emphasize low surface brightness features. It is found that the emission within 50″ of the galactic center is a superposition of thermal and nonthermal radiation. In broad outline both the nonthermal source and the smaller region of extended thermal emission have the same morphology: they appear elliptical with their major axes aligned along $b=2.77'$ and with their centroids at or very near the position of the compact radio source Sgr A*. In addition, dense clumps of thermal emission appear to define a spiral-like pattern which also has its center of symmetry within 2″ of Sgr A*. The gradients in gas density, synchrotron emissivity and velocity dispersion outward from Sgr A* suggest that we are viewing a transient phenomenon such as an inflating supernova remnant whose age is ~7500−22000 years. (10 refs.)

69723 The strength of Paschen-alpha in the Seyfert 1.9 galaxy V Zwicky 317. R.J.Rudy (Steward Obs., Univ. of Arizona, Tucson, AZ, USA), S.P.Willner.

Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L69-71 (15 April 1983).

Reports a measurement of the Paschen-α flux in the Seyfert 1.9 galaxy V Zwicky 317. Seyfert 1.9 galaxies are characterized by steep broad-line Balmer decrements and V Zw 317 has the steepest decrement (Hα/Hβ=15.1) of any member of this class yet studied. The Paα is less than one-sixth the case B value modified by reddening. Thus for the object, and possibly for the class as a whole, reddening alone cannot account for the observed line ratios. Radiative transfer effects are probably the dominant factor in producing the observed broad-line Hα/Hβ value. Recent models suggest that the required optical depths, temperatures, and densities in the broad-line region necessary to produce such a steep Balmer decrement are smaller than those thought typical for quasars. (20 refs.)

69724 Position angle variation of the major axis of some galaxies. A.I.Gamaleldin, I.A.Issa (Helwan Obs., Cairo, Egypt).

Astron. Nachr. (Germany), vol.304, no.1, p.21-8 (1983).

The variation in the direction of the major axis in three ellipticals, five lenticulars and three spirals is studied using B or V isophotic maps. There is a turning point in most of the curves especially for spirals and lenticulars. This turning point can be used to define the galaxy nucleus region. There seems to be a correlation between the rotation curve and the postion angle curve especially for NGC 2784 and NGC 3640. (8 refs.)

69725 Stellar statistical analysis in the neighbourhood of the Sun. N.G.Guseva, L.N.Kolesnik (Akad. der Wissenschaften, Kiev, Ukrainian SSR), M.D.Metreveli.

Astron. Nachr. (Germany), vol.304, no.1, p.41-4 (1983).

Space densities for stars in the 'Catalogue of nearby stars' (Gliese 1969) and in 'Nearby star data published 1969-78' are calculated as a function of distance from the galactic plane. The stars are symmetrically distributed with respect to the galactic plane. Space densities for giant stars nearer than 22 pc are also computed. The comparison between the luminosity functions of stars nearer than 5 pc and 22 pc shows that the number of M dwarfs up to 22 pc is incomplete. (11 refs.)

69726 The UV spectrum of the BL Lac object PKS 0521−36. I.J.Danziger (European Southern Obs., Garching Munchen, Germany), J.Bergeron, R.A.E.Fosbury, L.Maraschi, E.G.Tanzi, A.Treves.

Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.565-70 (May 1983).

Ultraviolet observations (1200-3000 Å) with the *IUE* satellite of the BL Lac object PKS 0521−36 are presented. The only emission line which appears clearly in the spectrum is Lyα, which is asymmetric with a component displaced ~3000 km s^{-1} to the red. The intensity of the line and the upper limits on other lines are compared with the model calculations on QSOs and Seyfert nuclei by Kwan & Krolik (1981). The continuous energy distribution is discussed, combining non-simultaneous observations from the ultraviolet to the infrared. The spectral range of the non-thermal source from far IR to far UV can be described by a single power law of index −1.5. (24 refs.)

69727 Stochastic effects in the chemical evolution of galaxies. S.D.M.White (Dept. of Astron., Univ. of California, Berkeley, CA, USA), J.Audouze.

Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.603-18 (May 1983).

Uses a simple model of mixing processes to investigate how fluctuations in element abundance in the interstellar medium may affect the chemical evolution of galaxies. The authors present a complete solution for the abundance distribution in a schematic inhomogeneous steady-state model in which infalling gas replaces material consumed by star formation. In addition, they give differential equations which describe the evolution of certain moments of the abundance distribution in more general models, together with a Monte Carlo scheme which can be used to simulate this evolution. The authors compare results for inhomogeneous generalisations of the infall model of Lynden-Bell with data on the abundance distribution of stars and gas in the solar neighbourhood. (21 refs.)

69728 An arcsec radio jet in NGC 1275 (Perseus A). A.Pedlar, R.V.Booler, R.D.Davies (Nuffield Radio Astron. Labs., Jodrell Bank, England).

Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.667-75 (May 1983).

Presents 73-cm radio continuum observations of NGC 1275 with an angular resolution of 1.2 arcsec. The observations show an unresolved core together with two weaker knots which the authors interpret as a radio jet in position angle ~160°. This jet may be associated with an optical filament in PA 172° which aligns precisely with the 2.8-cm VLBI jet and shows an unusually high velocity-gradient. This filament could be formed by the cooling of gas entrained into a beam in PA 172°. If this hypothesis is correct, then the radio knots are displaced 2→3 arcsec (~1kpc) from the axis of the beam. (27 refs.)

69729 Infrared colours of a complete sample of faint galaxies. R.S.Ellis (Dept. of Phys., Durham Univ., Durham, England), D.A.Allen.

Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.685-93 (May 1983).

Re-examines the infrared colour-redshift relation for galaxies of known redshift. The relation defined by measurements of optically selected galaxies lies fairly close to that expected from model predictions. Infrared colours may therefore offer a reasonable method for separating the effects of luminosity evolution and redshift when discussing optically selected samples of faint field galaxies. This method is applied to a complete sample of 47 field galaxies at optical magnitude 21.5. The infrared and optical data imply that a third of the field galaxies lie at redshifts beyond those expected from non-evolution models. The optical-to-infrared colours of these distant galaxies are generally bluer and the entire sample is consistent with a more vigorous star formation rate beyond a redshift of ~0.5. (21 refs.)

69730 Rotation curve of the edge-on spiral galaxy NGC 5907: disc and halo masses. S.Casertano (Scuola Normale Superiore, Pisa, Italy).

Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.735-47 (May 1983).

The dynamical consequences of a truncation in the disc of a spiral galaxy, like that suggested by the sharp decline of luminosity observed in the outer parts of some edge-on galaxies, are investigated, in relation to the interpretation of observed velocity curves. The disc truncation leaves a 'signature' on the rotation curve, in the form of a region of nearly constant velocity, followed by a steep decline of velocity just outside the truncation. Such a feature is clearly present in the observed rotation curve of NGC 5907, in which the luminosity truncation is also present. The observed velocity curve of NGC 5907 can be well reproduced by a two-component model, with a smooth spherical distribution of 'dark mass' (a halo) superimposed on the luminous disc. The best-fitting values for the mass in the disc and in the halo (inside the optical truncation) are 9 and 13.5×10^{10} solar masses, respectively. The mass-to-light ratio (luminosity in the J band) is about 11, in solar units. The model predicts the values of some quantities, such as the thickness of the gas layer, that could possibly be observed in the near future, thus providing a clear-cut test of the model itself. (18 refs.)

69731 Remarkable kinematics of the ionized gas in the nucleus of NGC 1365. M.M.Phillips, A.J.Turtle (Anglo-Australian Obs., Epping, NSW, Australia), M.G.Edmunds, B.E.J.Pagel.

Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.759-65 (May 1983).

The nuclear region of NGC 1365 shows emission from (i) H II regions ionized by young stars; (ii) a central Seyfert nucleus; and (iii) extended regions of high-excitation gas with [O III] 5007$\gg$Hβ, presumably located outside the disc of the galaxy and ionized by far-UV radiation and soft X-rays from the nucleus. New high-dispersion spectroscopic observations reveal a velocity field that is considerably more complicated than the simple rotating disc previously inferred from observations of Hα and [N II], particularly in the case of the high-excitation gas which shows non-circular or non-coplanar motion and line splittings over substantial areas. Preliminary interpretations are suggested involving either rotation in a tilted plane or ejection into the halo. (23 refs.)

69732 A dust lane in NGC 6251. J.-L.Nieto, G.Coupinot (Obs. du Pic-du-Midi et de Toulouse, Bagneres-de-Bigorre, France), G.Lelievre, C.Madsen.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.39p-43 (May 1983).
A dust lane cutting the central region of the radio galaxy NGC 6251 along its minor axis has been observed. This dust lane is roughly parallel to the radio jet. The implications of this observation are discussed. (27 refs.)

69733 Related galaxies with different redshifts?. H.C.Arp (Mount Wilson Obs., Pasadena, CA, USA).
Sky & Telesc. (USA), vol.65, no.4, p.307-9 (April 1983).
Various examples of these peculiar systems are discussed. The nature of the companions is briefly discussed. The existence of quasars associated with galaxies is also discussed. (no refs.)

The statistics of gravitational lenses: apparent changes in the luminosity function of distant sources due to passage of light through a single galaxy .... See Entry 69480

On disk accretion .... See Entry 69483

Polytropic spheres with isothermal cores .... See Entry 69484

Distant anticenter A-F stars and the galactic abundance gradient .... See Entry 69603

Stellar collapses in the Galaxy .... See Entry 69632

Supernova in ESO 270-G05 .... See Entry 69634

Supernova in NGC 4753 .... See Entry 69635

Supernova in NGC 4753 .... See Entry 69636

Tidal compression of a star by a large black hole. I. Mechanical evolution and nuclear energy release by proton capture .... See Entry 69643

The Hawking radiation of charged Dirac particles in Kerr-Newman spacetime .... See Entry 69644

Stationary axially symmetric perturbations of the Reissner-Nordstrom black hole .... See Entry 69645

Stellar orbits in a triaxial galaxy. I. Orbits in the plane of rotation .... See Entry 69678

The Galaxy's 157 micron [C II] emission: observations by means of a spectroscopic lunar occultation technique .... See Entry 69693

A survey of galaxy redshifts. V. The two-point position and velocity correlations .... See Entry 69734

A new evaluation of the four-point galaxy correlation function amplitudes .... See Entry 69735

Neutral hydrogen in X-ray cluster galaxies: A 1367 .... See Entry 69736

Extended H I emission associated with the low-surface-brightness companions of the S0 galaxy NGC 4026 .... See Entry 69738

The Horologium-Reticulum supercluster of galaxies .... See Entry 69739

A variable radio source in the clumpy irregular galaxy Markarian 297 .... See Entry 69741

Infrared counterparts to 'empty field' steep-spectrum radio sources .... See Entry 69743

A measurement of the IR flux from a radio lobe .... See Entry 69746

Common absorption systems in the spectra of the QSO pair Q0307−195A, B .... See Entry 69747

Multifrequency observations of OV 236 (1921−293) reveal an unusual spectrum .... See Entry 69751

The opacity of the universe and the strong equivalence principle .... See Entry 69769

Massive, degenerate neutrinos and cosmology .... See Entry 69771

98.50K Groups, clusters, superclusters

69734 A survey of galaxy redshifts. V. The two-point position and velocity correlations. M.Davis (Dept. of Astron. & Phys., Univ. of California, Berkeley, CA, USA), P.J.E.Peebles.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.465-82 (15 April 1983).
Describes the results of a study of the two-point correlations in the 14.5 m_B Harvard-Smithsonian Center for Astrophysics redshift survey. The distance information provided by the redshifts is used to estimate the two-point spatial correlation function $\xi(r)$ in a way that is designed to be unbiased by peculiar velocities. The results agree well with what has been found from the deeper angular distributions. (46 refs.)

69735 A new evaluation of the four-point galaxy correlation function amplitudes. J.N.Fry (Enrico Fermi Inst., Univ. of Chicago, Chicago, IL, USA).
Astrophys. J. (USA), vol.267, no.2, pt.1, p.483-7 (15 April 1983).
Applies the method of Bonometto and Lucchin (1980) for estimating the reduced four-point function amplitudes to the Lick galaxy count catalog, uses earlier results to test the expected scaling behavior, and summarizes the present state of knowledge of these parameters. (11 refs.)

69736 Neutral hydrogen in X-ray cluster galaxies: A 1367. G.L.Chincarini (Univ. of Oklahoma, Norman, OK, USA), R.Giovanelli, M.Haynes, P.Fontanelli.
Astrophys. J. (USA), vol.267, no.2, pt.1, p.511-14 (15 April 1983).
21 cm observations of X-ray galaxies in the cluster Abell 1367 show that the neutral hydrogen gas may coexist with the hot coronal X-ray gas. Such galaxies, however, are neutral hydrogen deficient. (3 refs.)

69737 The geometry of two superclusters Coma-A1367 and Perseus-Pisces. G.L.Chincarini (Dept. of Phys. & Astron., Univ. of Oklahoma, Norman, OK, USA), R.Giovanelli, M.P.Haynes.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.5-9 (May 1983).
An attempt is made to estimate the mean extension in depth of two large structures Coma-A1367 and Perseus/Pisces. These superclusters are favorable cases for such measurements because their longest dimension runs approximately perpendicular to the line of sight. A preliminary estimate gives for Coma-A1367, a mean width $\simeq$14 Mpc and a mean depth $\simeq$16 Mpc. For Perseus/Pisces the authors obtain a mean width $\simeq$12 Mpc and a mean depth $\simeq$24 Mpc. (20 refs.)

69738 Extended H I emission associated with the low-surface-brightness companions of the S0 galaxy NGC 4026. P.N.Appleton (Nuffield Radio Astron. Labs., Univ. of Manchester, Jodrell Bank, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.533-44 (May 1983).
An H I survey has been made of the S0 galaxy NGC 4026 and its nearby low-surface-brightness companions. Although the S0 galaxy was not detected in H I, filamentary neutral hydrogen was found in its near vicinity associated with the companion galaxies UGC 6956 and 6922. The distribution and kinematics of the gas strongly suggests that tidal interactions are taking place in this system. It is likely that the S0 galaxy dominates the gravitational potential of the group and is tidally stripping gas from its nearest companion UGC 6956. The outcome of this interaction may be the formation of an H I ring around NGC 4026 on a time-scale of 10^7-10^8 yr. It is suggested that the tidal capture of gas from small companion galaxies like UGC 6956 could provide a mechanism for the origin of outer H I rings in other S0 galaxies. (27 refs.)

69739 The Horologium-Reticulum supercluster of galaxies. J.R.Lucey (Astron. Centre, Univ. of Sussex, Brighton, England), R.J.Dickens, R.J.Mitchell, J.A.Dawe.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.545-63 (May 1983).
Redshifts, morphological classifications, orientations and ellipticities are presented for 129 galaxies with a 6°×6° region in Horologium-Reticulum centred on 3^h27^m, −53.5°. The survey shows that the prominent clusters in the region form a supercluster with a mean redshift around 18000 km s^{-1}. The region is dominated by two very rich clusters Cl 0329-527 (Klemola 8) and Cl 0342−538 (Calan 0340−538) which are separated by a projected distance of 8 h^{-1} Mpc ($h=H_0/100$ km s^{-1} Mpc^{-1}). The line-of-sight velocity dispersion of these clusters is discussed. Redshifts indicate that there is a bridge of galaxies connecting Cl 0342-538 to the prominent aggregate Cl 0326−537 which lies to the south-west of Cl 0329−527. The galaxy position angles are discussed. A simple two-particle model, assuming masses derived from the application of the viral theorem to each of the two very rich clusters is considered and the properties of the individual supercluster components are discussed. (31 refs.)

69740 An observational study of the dynamics of binary galaxies. S.D.M.White (Dept. of Astron., Univ. of California, Berkeley, CA, USA), J.Huchra, D.Latham, M.Davis.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.701-25 (May 1983).
Presents high quality radial velocities for all galaxies in Turner's (1976) catalogue of 156 binary systems. The observed velocity differences depend significantly on the environment of pairs and on the morphological type of their member galaxies. Velocity difference correlates extremely weakly with either luminosity or projected separation. Monte Carlo simulations of scale-free ensembles of binary galaxies show that this behaviour is inconsistent both with the hypothesis that the mass of a binary system increases linearly with its luminosity, and with the hypothesis that galaxies in pairs may effectively be treated as point masses. The data favour models where the galaxies interact through a quasi-isothermal potential which depends only weakly on their luminosity. (40 refs.)

Dwarf elliptical galaxies .... See Entry 69720

98.70 OTHER OBJECTS AND BACKGROUND RADIATIONS OF UNKNOWN ORIGIN AND DISTANCES

(for pulsars, see 97.60G)

98.70D Discrete radio sources

69741 A variable radio source in the clumpy irregular galaxy Markarian 297. D.S.Heeschen (Nat. Radio Astron. Obs., Charlottesville, VA, USA), J.Heidmann, Q.F.Yin.
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L73-6 (15 April 1983).
Six centimeter VLA observations of the clumpy irregular galaxy Markarian 297 (=NGC 6052) show that a compact source within the galaxy image increased by a factor of 3 in a time interval of 27 months. The authors suggest that the increase is due to supernova activity in a small region of extraordinary star formation activity within the galaxy. (12 refs.)

69742 High spatial resolution VLA observations of the R Aquarii jet. M.Kafatos (Dept. of Phys., George Mason Univ., Fairfax, VA, USA), J.M.Hollis, A.G.Michalitsianos.
Astrophys. J. Lett. Ed. (USA), vol.267, no.2, pt.2, p.L103-7 (15 April 1983).
High spatial resolution observations (~1″) of the jet feature associated with the symbiotic variable R Aquarii were obtained with the Very Large Array (VLA). The peak radio intensity of the jet lies at 29.3° PA with respect to the radio emission from R Aquarii itself. If the line defined by the jet and star is extended ~196″, it intercepts a previously reported and theretofore unresolved radio source. In the high spatial resolution 6 cm map, this feature is resolved into a compact double radio source, whose peak intensity lies on an axis defined by the jet and star. The possible association of this feature with R Aquarii or with the extended filamentary nebula that surrounds the system cannot be determined from these radio morphology studies alone. If this feature is associated with R Aquarii, it may represent ejecta from the system which occurred previously. Moreover, a new unresolved radio feature has been detected ~2.7″ from the central star at ~45° PA. It may represent material recently ejected from the system, perhaps as the object precesses. Weak evidence for a counter-jet suggested from radio contours centered on R Aquarii. (11 refs.)

69743 Infrared counterparts to 'empty field' steep-spectrum radio sources. M.J.Lebofsky, G.H.Rieke (Steward Obs., Univ. of Arizona, Tucson, AZ, USA), D.Walsh.
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.727-34 (May 1983).
A sample of steep-spectrum radio sources from the Jodrell Bank survey, which correspond to empty fields on the POSS has been observed using the Multiple Mirror Telescope IR photometer with a 9 arcsec diameter aperture positioned on the radio centroids. This technique has previously been successful with flat-spectrum sources, which are normally relatively compact, but has been thought to be inappropriate for steep-spectrum sources because they are usually extended and the position of the optical/IR counterpart may be too uncertain. Of a sample of 18 'empty field' sources, new detections have been made at K of 11 which, with four previous detections, gives a success rate of 15 out of the 18 sources and brings the optical/IR detection rate of a complete sample of 87 sources close to 100 per cent. For some detected sources magnitudes at J and H have also been determined, and it is shown that the IR colours can be used to classify objects. The sample apparently includes galaxies with z~1 and QSOs with very steep optical-IR spectra. (21 refs.)

69744 Asymmetries in four powerful radio sources. C.J.Lonsdale, I.Morison (Nuffield Radio Astron. Labs., Jodrell Bank, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.833-51 (May 1983).
The extragalactic radio sources 3C 153, 196, 249.1 and 268.4 have been observed at frequencies of 408 and 1666 MHz with the new MERLIN array operated by Jodrell Bank, giving resolutions of ~0.9 and 0.25 arcsec respectively. The sources show marked asymmetries about the central object in spectral index, flux and morphology, which are most naturally accounted for by the effects of a time-dependent asymmetry in the central powerhouse. In the case of 3C 249.1 the observations suggest that energy is being supplied alternately to the two sides of the source. The 1666-MHz observations also show that each of the other three sources contains one extremely compact hotspot. The minimum internal energy densities in these hotspots are such that confinement by ram pressure of motion through the intergalactic medium may not be possible, indicating that such features are transient phenomena in free expansion, or that some other confinement mechanism is operating. (31 refs.)

69745 Large-scale radio structures of superluminal sources. R.T.Schilizzi, A.G.de Bruyn (Radiosterrenwacht, Dwingeloo, Netherlands).
Nature (GB), vol.303, no.5912, p.26-31 (5 May 1983).
Westerbork Synthesis Radio Telescope maps of faint extended emission associated with several superluminal radio sources are presented. In order to avoid exceptionally large sizes for the superluminal sources, their dominant, long-term axes must be at least 20-30° from the line of sight. This is a considerably larger angle than that demanded by the relativistic beaming interpretation of the superluminal motion in their compact cores, and implies that a wobble or precession of their ejection axes has taken place. Superluminality may thus be a temporary phenomenon. (31 refs.)

69746 A measurement of the IR flux from a radio lobe. P.M.Allan (Sterrewacht Leiden, Leiden, Netherlands).
Nature (GB), vol.303, no.5912, p.45-6 (5 May 1983).
Prompted by the detection of optical radiation from the extended lobes and jets of some radio galaxies, the author has begun a search for IR radiation from such sources. Initially the author has observed the western lobe of 3C 247 (or 3C 247W) at 2.2 μm and measured a flux density of 250±27 μJy (m_K=16.0±0.1). This result shows there to be a break in the spectrum between radio and optical wavelengths, such that the IR-optical spectrum is steeper than would be predicted from the radio and optical data alone. If the spectrum of 3C 247W is applicable to other sources, then IR searches are a good way of finding high frequency counterparts of lobes of radio galaxies. (21 refs.)

Hydrogen sulfide in a circumstellar envelope .... See Entry 69594

The decreasing periods of R Aquilae and R Hydrae .... See Entry 69624

PSR 1937+214 .... See Entry 69637

Five years of photometry of λ Andromedae .... See Entry 69649

The magnetic field on the RS Canum Venaticorum star lambda Andromedae .... See Entry 69654

Confirmation of periodic radio outbursts from LSI+61° 303≡GT 0236+61 .... See Entry 69674

Ultraviolet spectroscopy of LSI+61 303 .... See Entry 69675

Formation of OB clusters: W33 complex .... See Entry 69679

VLA observations of the $^2\pi_{3/2}J=3/2$ OH masers associated with Orion A .... See Entry 69686

G29.7−0.3: another supernova remnant with an identity crisis .... See Entry 69692

High-density gas associated with 'molecular jets': NGC 1333 and NGC 2071 .... See Entry 69695

Positions of the SiO masers in Orion-KI: anisotropy on a scale of 70 AU .... See Entry 69696

Radio maps revealing shell structures in five supernova remnants .... See Entry 69700

Radio observations of the supernova remnant G 109.1−1.0 .... See Entry 69702

The optical emission from the supernova remnant HB 3 .... See Entry 69706

H I observations of the high-velocity system in NGC 1275 .... See Entry 69709

Further evidence for M87's massive, dark halo .... See Entry 69710

Are there correlations between radio and optical axes of radio galaxies? .... See Entry 69714

VLA observations of massive star formation in spiral nuclei .... See Entry 69721

The gas density and distribution within 2 parsecs of the galactic center .... See Entry 69722

An arcsec radio jet in NGC 1275 (Perseus A) .... See Entry 69728

3C 273 .... See Entry 69748

Radio source contributions to small-scale anisotropies of the microwave background .... See Entry 69753

98.70J Quasars

69747 Common absorption systems in the spectra of the QSO pair Q0307−195A, B. P.A.Shaver (European Southern Obs., Garching, München, Germany), J.G.Robertson.
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L57-61 (15 May 1983).
Common metal absorption systems have been found in the spectra of the SQOs Q0307−195A and B (separation 58″) at z=2.122, the emission redshift of the latter; the projected separation is 378 h^{-1} kpc, and the absorption redshifts differ from each other by only 77±14 km s^{-1}. This result, and that found previously for the pair Q0028+003/Q0029+003, strongly suggest the presence of very large (Mpc-diameter) gaseous halos or disks surrounding QSOs. Another pair of common metal absorption systems has also been found at a considerably lower redshift, z_{abs}=2.034. The redshift difference in this case is 297±14 km s^{-1} and the projected separation 376 h^{-1} kpc; the absorption may be due to one or possibly two foreground galaxies. A marginal tendency has been found among the remaining Lyα lines in the two spectra to correlate with each other at small velocity separations (≤500 km s^{-1}). (6 refs.)

69748 3C 273. P.A.R.Ade, I.G.Nolt, E.I.Robson, M.G.Smith.
I.A.U. Circ. (USA), no.3795, 1 pp. (29 April 1983).
Recent millimetre, submillimetre and infrared photometry of the quasar 3C 273 show that the source has flared over the year 1982-83. For example the 1.1 mm flux density increased from 12 Jy in April 1982 to 22 Jy in February 1983 and to 37 Jy in March 1983. The observations suggest that the flare may have propagated from the infrared to successively longer wavelengths. (no refs.)

69749 Optical positions of quasars. E.D.Clements (Royal Greenwich Obs., Hailsham, England).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.861-3 (May 1983).
Positions with an accuracy of about 0.1 arcsec are presented for 65 quasars observed with the 26- and 13-in refractors at the RGO. (6 refs.)

69750 On the Baldwin effect in optically-selected quasars. T.Kiang, F.H.Cheng, Y.Y.Zhou (Dunsink Obs., Castleknock, Dublin, Ireland).
Mon. Not. R. Astron. Soc. (GB), vol.203, no.2, p.25p-9 (May 1983).
Osmer (1980) has asserted that the apparent correlation between emission-line width and continuum luminosity (the Baldwin effect) in an optically-selected set of quasars could be due to observational selection effects. The data are divided into groups according to spectral index α and it is found that for the groups $0.0<\alpha<0.3$ and $0.8<\alpha<2.4$, the correlation is tight (dispersion ~0.7 mag.) and the points lie clear of the calculated cutoff. These 73 quasars define a mean relation $M_{cont}=18.28+3.77$ (log W_{em}-1.50), which differs little from the mean relation found in a radio-selected sample. (16 refs.)

69751 Multifrequency observations of OV 236 (1921−293) reveal an unusual spectrum. W.K.Gear (Dept. of Phys., Queen Mary Coll., London, England), E.I.Robson, P.A.R.Ade, M.J.Griffin, M.G.Smith, I.G.Nolt.
Nature (GB), vol.303, no.5912, p.46-7 (5 May 1983).
Examines the radio source OV 236 (1921−293) which has been classified both as a quasar and a BL Lac object. Its polarization and variability at 2.2 μm and generally featureless optical spectrum are consistent with it being a BL Lac object. The authors have obtained J, H, K, 10, 20, 800 and 1100 μm flux measurements of 1921−293 over a period of four days from the same telescope, enabling them to present a 'snapshot' of its IR to millimetre spectrum. (18 refs.)

The statistics of gravitational lenses: apparent changes in the luminosity function of distant sources due to passage of light through a single galaxy .... See Entry 69480

Polytropic spheres with isothermal cores .... See Entry 69484

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Infrared counterparts to 'empty field' steep-spectrum radio sources .... See Entry 69743

98.70L IR sources

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The strength of Paschen-alpha in the Seyfert 1.9 galaxy V Zwicky 317 .... See Entry 69723

3C 273 .... See Entry 69748

98.70Q X-ray and gamma-ray sources

69752 On the nature of two gamma bursts with spectral evolutions observed by the KONUS experiment. E.P.Liang (Lawrence Livermore Nat. Lab., Univ. of California, Livermore, CA, USA).
Astrophys. J. Lett. Ed. (USA), vol.268, no.2, pt.2, p.L89-92 (15 May 1983).
Several unique features of the evolving spectra of the 1979 April 2 B and 1979 November 11 gamma-ray bursts observed by the KONUS experiment can be used to determine a number of critical parameters of the sources, within the context of the thermal synchrotron model, including their luminosity distances. These results shed much light on the origin of these events and possibly of gamma bursts in general. (10 refs.)

Stellar rotation as a controller of coronae and chromospheres of giant stars .... See Entry 69609

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Another millisecond pulsar .... See Entry 69639

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Detection of $10^{10}M_\odot$ of hot gas in the normal elliptical galaxy NGC 5846 with the Einstein satellite .... See Entry 69719

Neutral hydrogen in X-ray cluster galaxies: A 1367 .... See Entry 69736

98.70S Cosmic ray sources

(for cosmic rays, see 94.40)

Cosmic rays from binary neutron stars .... See Entry 69453

98.70V Background radiations

69753 Radio source contributions to small-scale anisotropies of the microwave background. L.Danese (Osservatorio Astron., Padova, Italy), G.De Zotti, N.Mandolesi.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.114-18 (May 1983).
Presents calculations of radio source contributions to anisotropies in the microwave background on angular scales $1'\lesssim\theta_0\lesssim10°$. The uncertainties are small for $\lambda\geq6$ cm and $\theta_0\gtrsim10'$, where the fluctuation level follows directly from the available counts, and probably do not exceed a factor of 2 over this whole range of angular scales for $\lambda\geq2$ cm. The authors find that for $\lambda\lesssim3$ cm and $5'\lesssim\theta_0\lesssim2°$ radio sources yield $\Delta T/T\gtrsim10^{-4}$ and therefore seriously limit the detectability of truly primordial anisotropies. (37 refs.)

69754 Gravitational scintillation, anisotropies of background radiation and density inhomogeneities of cosmic matter. Fang Lizhi (Astrophys. Res. Div., Univ. of Sci. & Technol. of China, Hefei, China).
Sci. Sin. (China), vol.26, no.3, p.297-305 (March 1983).
The stochastic component in density inhomogeneities of cosmic matter can cause the intensity scintillation of sources at cosmological distances. This scintillation effect is one of the origins of the small angular anisotropy in the microwave background. That is, the density inhomogeneities in the epoch after the recombination would also contribute to the formation of background anisotropy. Therefore, an upper limit for the density inhomogeneities of cosmic matter can be obtained by the observation of the small angular anisotropy of background radiation. The result is that, if the Universe is closed, a strong inhomogeneity has never been evolved in the distribution of total density (including visible and invisible matter), namely, even at the present the total density distribution might still be rather homogeneous. (14 refs.)

Radio-astronomy antennas for 3K cosmic radiation measurements .... See Entry 69497

98.80 COSMOLOGY

(for observational cosmology, see 98.70V; for origin and evolution of galaxy, see 98.50)

69755 General vacuum-Universe solutions in Brans-Dicke cosmology. P.Chauvet (Dept. de Fisica, Univ. Autonoma Metropolitana, Mexico City, Mexico).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.51-8 (Feb. 1983).
By a rescaling of the scalar field ϕ of the Jordan-Brans and Dicke cosmology, the general solutions of the Friedmannian ‘vacuum’ Universe are obtained. Only the flat space solution was previously known. Each solution is characterized by the sign of the second time derivative of the rescaled field $\psi \equiv \phi R^3$ (R being the scale factor of the Robertson-Walker line-element): $\ddot{\psi}=0$ (flat space), $\ddot{\psi}<0$ (closed space), and $\ddot{\psi}>0$ (open space), so that the solutions are mutually exclusive. Of these, the open space one is damped-oscillatory and R attains its absolute minimum, equal to zero, in only one of the two ‘extreme’ cycles. Otherwise, R min remains positive. If the ϕ-field is dominant near the singularity, these solutions may have physical significance. Also obtained, by the method mentioned above, is the general flat space solution for a ‘dust’ Universe and from it a closed space ‘dust’ solution. Both were found before by different authors, each one using a different method and, therefore, seemed up to now unrelated. (7 refs.)

69756 Robertson-Walker cosmologies with a trace anomaly effect in their dynamical description. A.Woszczyna (Astron. Obs., Jagiellonian Univ., Krakow, Poland).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.75-8 (Feb. 1983).
The evolution of some vacuum spatially-flat Robertson-Walker universes filled with a massless conformally-invariant quantum field is presented in the energy density-curvature phase plane. (3 refs.)

69757 Parastatistics and the equation of state for the early Universe. R.Aldrovandi, I.Monte Lima (Inst. de Fisica Teorica, Sao Paulo, Brazil).
Astrophys. & Space Sci. (Netherlands), vol.90, no.1, p.179-95 (Feb. 1983).
The equation of state for an ideal mixture of relativistic quantum gases obeying any (para-)statistics is given. Recursion formulae are obtained for the distribution function and correlations are analysed. The equation of state can be applied to the early Universe, allowing the quarks to be treated either as coloured fermions or (unequivalently) as parafermions of order 3. In the latter case, they exhibit a tendency to aggregate into triads by a mere statistical effect. (18 refs.)

69758 Early Brans-Dicke axisymmetric Universe with magnetic field. S.P.Chakravarti (Phys. Dept., B.N. Mahavidyalaya, Bengal), U.K.De.
Astron. & Astrophys. (Germany), vol.121, no.1, pt.1, p.1-4 (May 1983).
The Brans-Dicke-Maxwell field equations in the presence of a magnetic field are sold for an axisymmetric metric in a radiation dominated early Universe. An expression for the magnetic energy-density is obtained. It is concluded that primordial magnetic fields may have had a profound effect in producing anisotropies of the Universe and in primordial element production. (8 refs.)

69759 On the behaviour of test matter in the neighbourhood of caustics of homogeneous cosmological models. H.G.Paul (Zentralinst fur Astrophys., Akad. der Wissenschaften, Potsdam-Babelsberg, Germany).
Astron. Nachr. (Germany), vol.304, no.1, p.13-19 (1983).
Using power asymptotes for the metric of Bianchi types I, V, VII$_0$, VIII and IX, the intensity of geodesic focused scalar test matter is calculated in the neighbourhood of the caustic singularities of these space-time models. In all the considered Bianchi types there is a caustic diffraction with a diffraction field bounded by regions of extinction depending on the structure of the gravitational lense. (16 refs.)

69760 Newtonian cosmology and Friedmann's equation. A.R.Thatcher.
Eur. J. Phys. (GB), vol.3, no.4, p.202-5 (1982).
Models of the expansion of the Universe can be derived from Newton's laws by the methods of hydrodynamics. The author shows that if the galaxies are regarded as discrete particles then an even simpler presentation is possible. It is also noted that a relativistic Universe which contains only a finite amount of matter may be indistinguishable, within the limits of observation, from a Friedmann Universe in which the total amount of matter is infinite. (5 refs.)

69761 Cosmology and elementary particles. J.D.Barrow (Astron. Centre, Univ. of Sussex, Brighton, England).
Fundam. Cosmic Phys. (GB), vol.8, no.2, p.83-199 (1983).
An introduction is provided to the growing amalgamation of elementary particle physics and big bang cosmology. An overview is given of the observational evidence for the content, composition and distribution of matter and radiation in the Universe. The theory of the standard Friedman model is developed and used as a testing ground for a variety of hypotheses regarding the existence and properties of elementary particles. In particular, the survival of massive neutrinos, charged leptons, quarks and hadrons is considered. The experimental evidence for massive neutrinos and the variety of astrophysical consequences of their existence are described. Nucleosynthesis in uniform, nonuniform and anisotropic models is described along with the limits that can be placed upon the number of neutrino generations by considering the synthesis of helium and deuterium. Analogous limits from particle physics are given. The rationale and evidence for a grand unification of fundamental forces is described. The generation of a nonzero baryon number in the early Universe is reviewed and shown to have consequences for the origin of galaxies. Finally, new developments concerning the ‘inflationary Universe’ and the astrophysical consequences of superheavy magnetic monopoles are outlined. (222 refs.)

69762 General solutions for a cosmological Robertson-Walker metric in the Brans-Dicke theory. J.M.Cervero, P.G.Estevez (Dept. de Fisica Teorica, Univ. de Salamanca, Salamanca, Spain).
Gen. Relativ. & Gravitation (USA), vol.15, no.4, p.351-6 (April 1983).
The general vacuum solutions of the Brans-Dicke theory in a cosmological Robertson-Walker-type metric are explicitly given. Several families of solutions have properties which essentially differ from the conventional Einstein theory. The geometry is not uniquely determined by the equations of motion, raising doubts about the ‘Machian’ character of the Brans-Dicke theory. The role of the cosmological constant is emphasized, in agreement with modern ideas of fundamental particle interactions. (10 refs.)

69763 Friedmann Universe and superluminal Dirac particles. S.K.Srivastava (Government Coll., Port Blair, India).
J. Math. Phys. (USA), vol.24, no.4, p.996-1000 (April 1983).
Superluminal Dirac particles are considered in a Friedmann Universe. It is concluded that if such particles were produced at the epoch of the big bang (as assumed by Narlikar and Sudarshan) and also that they survived up to the present time, their metamass should be less than 8.77×10^{-54} g. It is also concluded that the wavelength of these primordial tachyons (superluminal particles surviving to present time) would be greater than 4.56×10^{-23} cm. In this paper expressions for various physical parameters such as probability density and energy and rate of dissipation of energy for these particles are derived. (8 refs.)

69764 Nonlinear periodic waves in a self-gravitating fluid. D.Ray (Dept.of Phys. Dept., Queen Mary Coll., London, England).
J. Math. Phys. (USA), vol.24, no.4, p.1011-12 (April 1983).
Liang (1979) has obtained equations for nonlinear plane waves in a Jeans Universe. While Liang has studied the equation for a specific equation of state, this paper makes a general study. Among other things it is shown that only a subsonic propagation is possible. (1 ref.)

69765 Possibility of detecting relict massive neutrinos. V.F.Shvartsman, V.B.Braginskii, S.S.Gershtein, Ya.B.Zel'dovich, M.Yu.Khlopov (M.V. Keldysh Inst. of Appl. Math., Acad. of Sci., USSR).
JETP Lett. (USA), vol.36, no.6, p.277-9 (20 Sept. 1982). Translation of: *Pis'ma v Zh. Eksp. & Teor. Fiz. (USSR)*, vol.36, no.6, p.224-6 (20 Sept. 1982). [received: April 1983]
The coherent intensification of the interaction of relict massive neutrinos with grains of matter with a size on the order of the neutrino wavelength suggests that it might be possible to detect a galactic neutrino sea by virtue of the mechanical pressure which it exerts in the direction opposite that in which the solar system is moving in the Galaxy. (17 refs.)

69766 The rest mass of neutrinos and clustering in the early Universe. Fang Lizhi (Astrophys. Res. Div., Univ. of Sci. & Technol. of China, Hefei, China).
Kexue Tongbao (Foreign Lang. Ed.) (China), vol.27, no.12, p.1301-4 (Dec. 1982).
The clustering of matter in the early Universe would be substantially affected by neutrinos with nonzero rest mass. The author considers this influence on Jeans clustering. (7 refs.)

69767 The future of the Universe. D.N.Page, M.R.McKee (Pennsylvania State Univ., University Park, PA, USA).
Mercury (USA), vol.12, no.1, p.17-23 (Jan.-Feb. 1983).
The authors discuss the future of the Universe from a thermodynamic viewpoint. It is shown that if the density of the Universe is less than or equal to the critical density (i.e. for a hyperbolic Friedmann model with $k=-1$ or a flat Friedmann model with $k=0$) the Universe never reaches thermal equilibrium. However, in the $k=0$ Friedmann model the entropy of the Universe may increase without limit owing to the formation and annihilation of positronium and the coalescence and evaporation of black holes. The implications of this state of thermal disequilibrium and unlimited increase in entropy for the continued existence of life in the Universe are discussed. (no refs.)

69768 Asymptotic freedom and entropy in a perpetually oscillating Universe. M.A.Markov (Inst. for Nuclear Res., Acad. of Sci., Moscow, USSR).
Phys. Lett. A (Netherlands), vol.94A, no.9, p.427-9 (4 April 1983).
A model of a perpetually oscillating Universe is considered. In this model the Universe, when contracting to Planck dimensions, transforms from the Friedmann to the De Sitter phase with one and the same $\Lambda \sim 1/l_{\mathrm{Pl}}{}^2$, irrespective of the value of the total bare mass of the Friedmnan Universe. (9 refs.)

69769 The opacity of the universe and the strong equivalence principle. V.M.Canuto, I.Goldman (NASA, Goddard Space Flight Center, New York, NY, USA).
Phys. Lett. A (Netherlands), vol.95A, no.1, p.65-8 (11 April 1983).
A possible explanation of why the advanced (i.e. acausal) solutions of Maxwell's equations are not observed in nature is by way of absorption by an opaque Universe. As Davies (1977) has shown, the ever expanding, general relativistic cosmological models fail to provide the needed absorption. This is perhaps not surprising. In fact, the absorption mechanism calling for an interplay between local physics and cosmology, is usually developed adopting the strong equivalence principle, SEP, which precludes such interplay. The authors show that complete absorption of electromagnetic radiation by ionized intergalactic plasma is obtained provided a violation of the SEP, of the order of the Hubble's constant, is allowed to occur. The same degree of violation was previously found to be compatible with a large body of observational data. (14 refs.)

69770 The early Universe and high-energy physics. D.N.Schramm (Dept. of Astron. & Astrophys., Univ. of Chicago, Chicago, IL, USA).
Phys. Today (USA), vol.36, no.4, p.27-33 (April 1983).
Many properties of the new particle field theories can only be tested by comparing their predictions about the physical conditions immediately after the Big Bang with what one can reconstruct about this event from astronomical data. (15 refs.)

69771 Massive, degenerate neutrinos and cosmology. K.Freese (Astron. & Astrophys. Centre, Univ. of Chicago, Chicago, IL, USA), E.W.Kolb, M.S.Turner.
Phys. Rev. D (USA), vol.27, no.8, p.1689-95 (15 April 1983).
Modifications to the standard big-bang neutrino cosmology resulting from a nonzero chemical potential are discussed. Cosmological neutrino mass limits as a function of μ/T are derived. Implications for galaxy formation in a Universe with degenerate neutrinos are emphasised. (16 refs.)

69772 Stability and structure of Newtonian gravitars. I.S.Nurgaliev (M.V. Lomonsov Moscow State Univ., Moscow, USSR).
Sov. Phys. J. (USA), vol.25, no.7, p.672-5 (July 1982). Translation of: *Izv. VUZ Fiz. (USSR)*, vol.25, no.7, p.98-102 (July 1982). [received: May 1983]
The solution $\chi \sim r^2$ for a scalar field (gravitational ‘constant’), which is asymptotically exact for supercompact configurations and which Saakyan and Mnatsakanyan obtained from the numerical solution of the hydrostatics equations in the Newtonian approximation of the Jordan-Brans-Dicke theory, is

used to study the gravitational stability of such configurations. The author has found that the stability condition $\gamma \geq 2/3$ for polytropic configurations (γ is the polytropic exponent) instead of $\gamma \geq 4/3$, which is known for configurations of low compactness. Analytic solutions of the equations of internal structure are found for configurations which are intermediate with respect to stability ($\gamma = 2/3$) and for some other important series of configurations. (9 refs.)

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